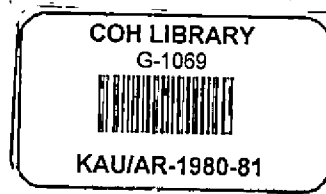


# ANNUAL REPORT

1980-'81



KERALA AGRICULTURAL UNIVERSITY  
VELLANIKKARA, TRICHUR

English

**ANNUAL REPORT, 1980-'81**

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# General Report

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The Executive Committee of the Kerala Agricultural University presents to the General Council, the 9th Annual Report of the University for the period from 1-4-1980 to 31-3-1981.

The report presented in the following chapters pertains to general administration, education, research, extension education, works, finance & accounts and estate. Membership of the statutory bodies of the University as well as the list of scientific, administrative and supporting staff, list of publications by the members of the scientific staff etc. have been appended.

Sri. N. Kaleeswaran, IAS, continued as the Vice-Chancellor of the University after being given a second term of appointment as the Vice-Chancellor. He continued as a member of the ICAR Society and of the Norms and Accreditation Committee of the ICAR. Since September 1980, Sri. Kaleeswaran became the President of the Indian Agricultural Universities' Association. He was nominated by the State Government to the State Planning Board as a part-time member.

Sri. E. Damodara Marar, Additional Secretary to the Government of Kerala continued as the Registrar. Sri. P. Rajagopala Pillai, Comptroller left the University service on 7-4-1980 to take up assignment as Financial Advisor, Bansager Control Board, Madhya Pradesh. Sri. Damodara Marar, Registrar held additional charge of the post of Comptroller till Sri. N. M. Abdul Kadir took over as the Comptroller on 15-6-1980.

Dr. N. Sadanandan and Dr. M. J. Sebastian continued as the Dean, Faculty of Agriculture and the Dean, Faculty of Fisheries, respectively. Dr. M. Krishnan Nair was appointed Dean, Faculty of Veterinary & Animal Sciences with effect from 3-9-1980. Dr. A. Venugopalan, Professor (Research Co-ordination - Veterinary) held additional charge of the post till Dr. Krishnan Nair took over. Dr. P. C. Sivaraman Nair continued as the Associate Dean of the College of Horticulture till 9-3-81, after which Dr. P. K. Gopalakrishnan, Professor of Horticulture (Coconut), KADP held full additional charge of the post. The duties and functions of the Dean, PG studies were continued to be looked after by the Deans/Assoc. Dean of Colleges.

Dr. V. S. S. Potti and Sri. N. Sivathanu Pillai continued as the Director of Extension and the Director of Physical Plant. Prof. P. N. Pisharody, Project Co-ordinator (Rice) was in full additional charge of the

post of Director of Research till 9-3-1981 when Dr. P. C. Sivaraman Nair tookover as the Director of Research. The posts of Librarian and Director of Students' Welfare remained vacant during the year. Sri. N. N. Ramankutty continued as the Director of the Institute of Agricultural Technology, Tavanur.

The budget for the year recorded a receipt of Rs. 606 lakhs and an expenditure of Rs. 597 lakhs. The main source of income continued to be the grant-in-aid from the State Government.

The General Council, the supreme authority of the University was reconstituted on 31-1-1980 excluding the representatives of the Kerala, Calicut and Cochin Universities and the members from the State Legislature. These positions were filled up during the period under report.

An Accounts Committee under the Chairmanship of Prof. K. C. Chacko and an Assurance Committee with Sri. E. Gopalakrishna Menon as the Chairman were constituted by resolution of the General Council.

M/s R. Narayanan and George J. Mathew, members of the General Council resigned on 26-9-1980 and 27-11-1980, respectively. Sri. K. P. Joseph expired on 13-1-1981. The Chancellor nominated M/s. G. Sudhakran Nair, K. P. Chelly and P. C. Joseph as members of the General Council on 12-3-1981.

The Executive Committee, the chief executive body of the University was reconstituted on 5-8-1980 as follows:

The Vice-Chancellor, Kerala Agrl. University (Chairman)

The Agricultural Production Commissioner

The Secretary, Development Department

The Special Secretary, Finance

Dr. E. J. Silas, Director, CMFRI, Cochin

Dr. M. J. Sebastian, Dean, Faculty of Fisheries

Dr. D. M. Thampy, Professor of Fisheries

Sri. O. Luckose, MLA

Sri. P. R. Francis, Ex MLA

Sri. K. P. Joseph, Kayalparambil, Ponga P.O., Moncompu (till 13-1-81)

Sri. G. Sudhakran Nair, Nallaveetil, Karimulakkal P. O., Alleppey District (from 12-3-81)

Sri. C. P. Narayanan, Editor, Chintha Weekly

The Registrar, Kerala Agricultural University (Convenor)

(ii)

The following sub-committees of the Executive Committee were constituted/reconstituted during the period under report;

<b>Sub-committees</b>	<b>Chairmen</b>
Finance Committee	Vice-Chancellor
Establishment Committee	Sri. C. P. Narayanan
Student Welfare Committee	Dr. D. M. Thampy (Member Convenor)
Planning & Development Committee	Vice-Chancellor
Sports Board	Vice-Chancellor
Statute sub committee	Sri. C. P. Narayanan
Works Committee	Vice-Chancellor

The General Council held two ordinary meetings and two special meetings besides the annual meeting. The council at its meeting held in July 1980 approved the starting of a four-year degree programme in Co-operation and Banking under the University from the academic year 1981-82. Other important decisions of the Council included (i) the constitution of an Assurance Committee to watch the implementation of the decisions of the General Council from time to time, (ii) grade promotions to the teachers of the University taking into account the length of service on the basis of an assessment and (iii) organisation of district level seminars in all the districts with the co-operation of the Department of Agriculture.

Three statutes and five amendments were issued during the period (Annexure VIII).

The Academic Council held three special meetings and two ordinary meetings during the year. The Council formed a sub-committee to review the syllabi of B. Sc. courses in Agriculture and Horticulture. Based on the report of the sub-committee, the curricula for the first year of B. Sc. (Ag.) and B. Sc. (Hort.) courses were restructured during the period. The Academic Council also approved the starting of a seven-trimester diploma course in Agricultural and Rural Engineering.

The meeting of the "ICAR Regional Committee No. 8" was held at the KAU Headquarters on 21st and 22nd August, 1980.

Selection and appointment to the various teaching posts in the Faculty of Fisheries were made during the period. Four Associate Directors were appointed in the Directorate of Research. The vacancies in the Faculty of Agriculture and Veterinary & Animal Sciences were also filled up from the select list of candidates or by conducting fresh selections where there was no valid select list.

## TEACHING

The teaching institutions under the University are the College of Agriculture at Vellayani, Trivandrum, the College of Horticulture at Vellanikkara, Trichur, the College of Veterinary & Animal Sciences at Mannuthy, Trichur, the College of Fisheries at Panangad, Cochin and the Institute of Agricultural Technology at Tavanur, Malappuram. Courses leading to Bachelor's degree in Agriculture, Horticulture, Veterinary & Animal Husbandry, Fisheries Sciences; Master's degree in Agriculture, Horticulture, Veterinary Sciences and Ph. D. degree in Agriculture, Horticulture and Veterinary Sciences were continued to be offered. The diploma in Agricultural Sciences as well as the diploma in Agricultural and Rural Engineering were offered from the Institute of Agricultural Technology. Post-graduate diplomas in Natural Rubber Production and Land & Water Resources Development & Management were offered at the College of Horticulture, while the PG diplomas in Plant Protection and Soil Science were offered from the College of Agricultural. The College of Veterinary and Animal Sciences offered a specialised diploma course in Veterinary & Animal Sciences.

There were 272 teachers in the above institutions. Ninety five of the teachers were doctorates. The number of teachers in the different institutions is shown categorywise:

	Colleges				I. A. T.	
	Agri.	Hort.	V&AS	Fisheries	Tavanur	Total
	@					
Dean/Assoc. Dean*/Director	1	1*	1	1	1@	5
Professor	9	6	17	1	-	33
Assoc. Professor	24	13	29	7	-	73
Asst. Professor	30	19	26	8	4	87
Junior Asst. Professor	29	9	23	8	5	74
Total	93	48	96	25	10	272

Additional teaching posts created during 1980-81 in the Colleges of Agriculture/Horticulture/Veterinary and Animal Sciences/Fisheries and in the Institute of Agricultural Technology were as follows:

Posts	Colleges				I. A. T.	
	Agri	Hort.	V&AS	Fisheries	Tavanur	Total
Professor	...	...	...	...	1	1
Assoc. Professor	...	...	...	...	1	1
Asst. Professor	...	...	...	4	...	4
Junior Asst. Professor	...	7	...	...	...	7
Total	...	7	...	4	2	13



The following vacancies existed in the academic institutions during the year:

	Colleges				I. A. T.	
	Agri.	Hort.	V&AS	Fisheries	Tavanur	Total
Dean/Assoc. Dean/Direotor @	...	...	...	...	1@	1
Professor	...	3	2	2	...	7
Assoc. Professor	6	3	4	1	1	15
Asst. Professor	...	7	7	2	2	18
Junior Asst. Professor	2	2	3	...	4	11
<b>Total</b>	<b>8</b>	<b>15</b>	<b>16</b>	<b>5</b>	<b>8</b>	<b>52</b>

Two hundred and seventy four students were admitted for the degree courses [128 for B. Sc. (Ag.), 40 for B. Sc. (Hort.), 76 for B. V. Sc. & A.H. and 30 for B.F.Sc.]. Of the 95 Master's degree students. 48 were for M.Sc. (Ag.), six for M.Sc. in Agrl. Economics, five for M.Sc. in Agrl. Statistics, four for M.Sc. in Agrl. Engg., 14 for M.Sc. (Hort.) and 18 for M.V.Sc. Eleven students were admitted for Ph.D. course in Agriculture and six for Ph.D. in Horticulture. Fifty students were admitted for the diploma course in Agrl. Sciences and 31 for the newly started diploma course in Agrl. & Rural Engineering. Thirty students were admitted to the P. G. diploma courses [three for Natural Rubber Production, Seven for Soil Science, three for Plant Protection, five for Land & water Resources Development & Management and 12 for Veterinary and Animal Sciences].

The total number of students in the various teaching institutions of the University were as follows :

Courses	Colleges				I. A. T.	
	Agri.	Hort.	V&AS	Fisheries	Tavanur	Total
Graduate Programme	280	289	254	55	—	879
Masters Programme	76	65	64	—	—	205
Doctoral Programme	30	12	10	—	—	52
P. G. Diploma	10	8	21	—	—	39
U. G. Diploma	—	—	(2 batches)	—	170	170
<b>Total</b>	<b>396</b>	<b>374</b>	<b>349</b>	<b>55</b>	<b>170</b>	<b>1344</b>

One hundred and eighty two students from outside Kerala State were on the rolls of the University. Of these, 32 were at the College of Agriculture, 81 at the College of Horticulture, 65 at the College of Veterinary and Animal Sciences and four at the College of Fisheries. The students came from Lakshadweep, Andhra Pradesh, Pondicherry, Tripura, Meghalaya, Manipur, Bhutan and Jammu & Kashmir. There were four international students also—one each from Kenya, Nigeria, Tanzania and Zimbabwe.

Eight hundred and forty eight students received scholarships/ assistance from various sources—233 in the College of Agriculture, 281 in the College of Horticulture, 187 in the College of Veterinary and Animal Sciences, eight in the College of Fisheries and 133 in the Institute of Agricultural Technology.

Hostel facilities were availed of by 1028 students. The students of the College of Fisheries were accommodated in the Hostels of the College of Veterinary and Animal Sciences.

During the year under report, 166 students graduated, 42 obtained their Master's and six, their Doctorate degrees. Forty two students received the Diploma in Agrl. Sciences and 19, their P. G. Diplomas.

## RESEARCH

The research programmes of the University have been drawn out with emphasis on solving location specific, farm oriented problems encountered by the farming community of Kerala. The research projects under the National Agricultural Research Project have been formulated giving stress for overcoming the local constraints to agricultural production. Studies of basic and fundamental nature are mainly taken up by the Departments of the constituent Colleges of the University as departmental investigations and under post-graduate programmes. Problem oriented research of applied nature are conducted in the various Research Stations of the University and through specific research projects/schemes operated in the different agro-climatic zones of the State under plan schemes and those supported by other financing agencies like ICAR, CADA, KADP, NARP etc. Adaptive research is also undertaken for evaluation and refinement of newly developed technology under farmers' field conditions for ensuring acceptance at the beneficiary level.

The Research Council was reconstituted on 1-1-1981 by co-opting more members from the Faculties of Agriculture, Veterinary and Animal Sciences and Fisheries, besides from bodies like the Executive Committee, General Council and from among the progressive farmers of the State.

The strength of Scientific and supporting staff stationed at the various research centres of the University is furnished in Appendix IV.

The following posts were created additionally during the period under report:

Campuses/Institutes	Assoc. Director	Prof-essor	Assoc. Prof-essor	Asst. Prof-essor	Junior Asst. Prof-essor
Scheme for research & development of farm implements and machinery during VI Plan	—	—	—	—	1
Kerala Agrl. Extension Project	—	—	—	—	4
NARP sub project Strengthening Directorate of Research	3	—	—	—	—
NARP sub project for Northern Zone Strengthening Regional Agrl Res. Station. Pilicode.	1	2	16	5	—
NARP, Panniyur Centre	—	1	—	—	—
NARP, Tavanur Centre	—	—	—	3	—
Project on adaptive trials of improved varieties of annual oil seed crops, attached to Res. Station and Instructional Farm, Mannuthy.	—	—	—	1	—
Co-ordinated Project on Water Management, ARS, Chalakudy	—	1	—	—	—
Directorate of Monitoring and Planning, KAU HQrs.	—	1	—	—	—
Project for investigating root (wilt) disease of coconut in Kerala.	—	4	3	7	8
Starting a degree programme in Banking and Co-operation to be started from 1981-82	—	—	4	—	3

The details of the posts remaining vacant during the year in the research centres of the University are given below:

Name of Stations/ Farms/Schemes	Prof.	Assoc. Prof.	Asst. Prof.	Junior Asst. Prof
KADP, Vellanikkara	1	—	—	1
Agrl. Bye Products, Mannuthy	—	—	—	1
AICRP on Poultry, Mannuthy	—	—	1	—
AICRP on Goats, Mannuthy	—	—	1	—
Pig Breeding Farm, Mannuthy	—	—	—	1
Instructional Farm, Mannuthy	1	—	1	2
Fodder Research, Mannuthy	—	—	—	1
AICC & AIP, Madakkathara	—	—	1	1
L. R. S., Thiruvazhamkunnu	—	—	—	2
AICRP on Sugarcane, Thiruvalla	—	—	—	2
S. R. C. Punalur	—	—	1	—
S. R. C. Idukki	—	—	1	—
Regional Research Station, Pilicode	—	1	4+1*	—
NARP, Pilicode	—	12	3	—
H. R. S. Ambalavayal	—	1	1	—
P. R. S., Panniyur	—	1	2	1
N. A. R. P., Panniyur	1	—	—	—
B. R. S. Kannara	—	—	3	2
C. R. S. Pampadumpara	—	1	2	2
A. R. S., Chalakudy	—	2	1	—
R. R. S., Pattambi	—	1	5	—
R. R. S., Kayamkulam	—	—	3	—
Extn. Edn. Centre, Kayamkulam	—	1	—	—
R. R. S., Moncompu	—	1	1	2
C. R. S. Kumarakom	—	—	—	3
Root Wilt, Kumarakom	—	—	2	2
Instructional Farm, Vellayani	—	—	—	2
Root Wilt, Main Lab., Vellanikkara	3	—	2	—
Training Service, Communication Centre, Strengthening Comm. Centre	—	—	1	—
Information Unit, Ex. & Graph Service & N. D. Scheme	—	2	2	—
Peechi Command Area, Vellanikkara	—	—	—	4
AICRP on Agrl. Drainage, Karumady	—	1	2	—
Starting degree Course on Co-operation	—	3	—	—
Faculty of Basic Science and Humanities	4	1	12	—

\* Research Officer

Publications made by the members of staff of Research Stations are listed in Appendix V.

The Faculty Research Committee for Agriculture met three times (May, July and November) and approved 152 new research projects for implementation in the various research centres. The Faculty Research Committee (Veterinary & Animal Sciences) met during April and approved 44 new projects (Appendix VII).

The following new schemes were forwarded to the ICAR for approval and financial support:

Influence of tapioca consumption on thyroid function in animals  
Some physiological aspects of Indian elephants

Nutritional evaluation of the newly evolved pulse varieties in the KAU

Studies on the strains of *Rhizobium* of pulses, the effect of nutrients on them and standardisation of mass culturing technique

Toxic effects of industrial effluents on animals  
Microbial pneumonia of goats

Mechanical control and utilization of floating type aquatic weeds  
Post harvest technology of perishable foods

Project proposals for "water management studies in Kerala using ground water" were formulated and presented to the SIDA evaluation team during December 1980 for approval and financial support.

Administrative sanction was accorded by the ICAR for the implementation of an *ad hoc* scheme on "adaptive trials for improved varieties of annual oil seed crops in Kerala". The ICAR sanctioned a sub-centre at Vellanikkara under the AICC & SIP for undertaking research on ginger and turmeric. An ICAR Co-ordinated Project on "Agricultural drainage under actual farming conditions on watershed basis" was sanctioned to evaluate the drainage requirements of agricultural lands in Kuttanad, including the development of suitable criteria for the design of surface and sub-surface drains. The project would also involve the development of the project area (development of irrigation resources, construction of suitable water conveyance and distribution systems, land development, suitable cropping patterns and agronomic practices to obtain a high level of production and income). The socio-economic benefits obtained from the project would be properly evaluated.

Administrative sanction has been accorded for the implementation of the following NARP sub-projects:

Setting up of a Regional Agricultural Research Station at Pilicode for a period of five years from 1-6-80 at an estimated cost of Rs. 110.43 lakhs

Strengthening of the Directorate of Research for a period of five years from 1-6-80 at an estimated cost of Rs. 10.83 lakhs

The University submitted to the ICAR, sub-project proposals for the Southern, Central and Region of Problem Areas.

A project for investigation on root (wilt) disease of coconut which was submitted to the Government of Kerala by the University was sanctioned for implementation. Under the project, an inter-disciplinary approach is envisaged for undertaking field studies and laboratory investigations. Field studies will be conducted in four centres (Kumarakom, Moncompu, Kayamkulam & Vyttila) in the root (wilt) disease affected areas. Trials will be laid out in cultivator's field also. The main laboratories are being established at the College of Horticulture, Vellanikkara.

Prof. A. G. G. Menon, Dr. V. Gopinathan Nair and Dr. C.C. Abraham were nominated to the State Level Technical Committee which was constituted by the Government of Kerala to provide a formal mechanism for review of University research and field trials, and for review of future research programmes in relation to the recommendations from the District Technical Committee.

### *Research highlights*

#### **AGRICULTURE**

##### **Crop improvement**

The rice culture M-15-36-2 developed at the Rice Research Station, Moncompu from the cross between IR-11-1-66 x Kochuvithu has been found to be superior to Jyothi in yield and tolerance to pests and diseases. This culture was released as MO-5 by the State Seed Committee and included in the package of practices recommendations as a variety suitable for both the cropping seasons in Kuttanad area.

Kayamkulam 1, a derivative of the cross between Kottarakkara 1 and Poduvi was released from the Rice Research Station, Kayamkulam. The variety, named as Lakshmi, is photosensitive and suited for the second crop season in the eastern lateritic regions of Quilon and Alleppey districts.

The rice culture 174 evolved at the Rice Research Station, Vyttila through pure line selection from Cheruvirippu was released as Vyttila-2 for cultivation in the acid saline areas in the pokkali regions of Ernakulam and Alleppey districts during viruppu season.

Two rice cultures developed at the Rice Research Station, Pattambi, Cul. 1945 (Jaya x IET 2508) and Cul. 1954 [(Jaya x IR 2071) x Mashoori] have been identified as resistant to sheath blight. The medium tall rice culture 1907 (Triveni x Bhavani) was found suitable for dry sowing in the uplands during viruppu season. Another selection from this Research Station (Cul. 25100) identified earlier as promising for the saline areas, has been found to be suitable for non-saline areas also for the mundakan season. This culture has also been found to show resistance to BPH and sheath blight, under the all India screening trials.

At the Rice Research Station, Moncompu a BPH tolerant culture (1537-2) was evolved from the cross Triveni x Cul. 1539. This culture was also found to tolerate sheath blight and sheath rot diseases. Another culture, M22-65-2-3-1 (Jaya x MO-1) developed in this Station was found to be a high yielding culture with low BLB, sheath blight and sheath rot incidence.

Two cultures developed from the Instructional Farm, Mannuthy, Cul. 10-1-1- (Ptb 10 x Trn 1/2) and Cul. 703 (IR8 x H4) have been identified as promising, in the comparative yield trials conducted.

Multilocal trials conducted with different varieties of tumeric indicated that VK-5 and Chayapasupa are types suited for Kerala.

The ginger type Maran was found to be least susceptible to the leaf spot.

Among the germplasm collection of cashew types, BLA-139-1 recorded the highest yield. The hybrid progeny H-4-7 (30 A x BR)- 18 was found to yield maximum among the types tested.

The tomato line CL-32-D-0-19 GS obtained from the Asian vegetable Research and Development Centre, Taiwan showed fair amount of tolerance to bacterial wilt.

The chilli variety 'Blue' produced maximum yield and was found to be tolerant to the leaf curl complex disease.

The sweet potato hybrid H 4126 out-yielded the others in the comparative yield trials.

The brinjal line SM-6 exhibited resistance to bacterial wilt.

The sesamum multipoded hybrid variety Kayamkulam-2, evolved at the Rice Research Station, Kayamkulam was released under the name "Thilothama" for cultivation in the rice fallows of Onattukara sandy tract during the third crop season.

The mid-late variety of sugarcane CO.62175 was identified as a high yielder and was released for cultivation in the factory areas of Pandalam and Pulikeezh sugar mills.

### Crop management

Application of 2, 4-D sodium salt at the rate of one kg/ha mixed with 10 kg of urea/ha on the 20th day after transplanting/sowing was found equally effective and more economical than spraying this weedicide (2, 4-D) to control the weeds in rice fields. Incorporation of azolla in rice fields could save 25 percent of the inorganic nitrogen required for rice. But the economics will have to be worked out before advocating the same. Application of nitrogen in the form of sulphur coated urea and urea super granules increased the nitrogen use efficiency in rice fields of Pattambi.

Dipping the (lower) cut end of pepper cutting in IBA solution (1000 ppm) improved the rooting and establishment. It was demonstrated that pepper can be grown as a bush in flower pots or as a floor crop in the multi-tier system. The pepper variety Panniyur 1 responded well to N application at 60 g/plant/year.

Clove seeds collected and sown during the month of June recorded the highest percentage of germination. Nursery practices for cardamom were standardised and included in the package of practices.

Tissue tests for detecting nutrient deficiency in cocoa, ginger and turmeric were standardised. Studies revealed that cocoa beans produced in the State are not generally acidic, provided they are properly fermented and dried. Foliar spray of 1.5 percent zinc sulphate corrected the zinc deficiency disorders of cocoa.

A fertilizer dose of 100 g N, 200 g  $P_2O_5$  and 400 g  $K_2O$  proved best for rainfed banana cultivar "Palayankodan". Banana cultivar "Nendran" responded well to irrigation scheduled at IW/CPE=0.9 at fortnightly intervals.

Bitter gourd gave maximum yield at fertilizer levels of 50kg N, 25 kg  $P_2O_5$  and 25 kg  $K_2O$  per ha. Application of 60 kg N and 60 kg  $P_2O_5$ /ha significantly increased the yield of bhindi. The economic dose of N for cucumber was found to be 46 kg/ha.



Intercropping tapioca with groundnut, cowpea, greengram and blackgram improved the net income from unit area without reduction in tuber yields. Cowpea seeds inoculated with rhizobium and pelleted with lime produced better yields. Greengram and blackgram grown in rice fallows responded well to the fertilizer schedule of 20kg N, 30 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O/ha.

### Plant protection

Carbaryl, Fenitrothion, Fenthion, Monocrotophos, Methyl parathion and Dimecron proved to be safe pesticides in the pokkali rice fields where fish culture is also practiced.

Key for identification of rice diseases was formulated and included in the package of practices recommendations, together with the control measures.

A synthetic pyrethroid Ripcord 5 E. C. proved better in controlling pests on rice. Insecticide Elsan 50 EC 1000 ml/ha effectively controlled rice thrips, leaf roller and stem borer. Spraying Phoxium on gunny bags used for storage of paddy grains protected the grains from infestation of storage pests.

Sevidol 4.4 G granules at the rate of 20 kg/ha controlled root nematodes infesting rice. Occurrence of cyst nematodes in rice fields of Kerala was detected and the control measures scheduled for checking the attack.

Planting pepper cuttings in potting mixture drenched with 0.05 percent solution of Emisan-6 controlled the rotting disease in the nursery.

Application of Quinalphos 0.1 percent or Thimet at 30g/6m<sup>2</sup> of cardamom nursery prevented the attack of shoot fly on cardamom seedlings. Cuman 0.1% was found to be effective in controlling the leaf spot of ginger.

Control measures were formulated for preventing the attack of sigatoka disease on banana.

Fenitrothion applied twice at monthly intervals gave the best control against sweet potato weevil. Nursery treatment with Carbofuran at 0.4 g/m<sup>2</sup> controlled the root knot nematode attack on brinjal.

Phoxium, mixed with pulse seeds at 15 ppm, gave effective control of the pulse beetle incidence during storage. *Rhizoctonia solani* caused severe collar rot and web blight of cowpea.

Combination of insecticides and the nuclear polyhedrosis virus exhibited synergic effect on the control of *Spodoptera* in rice.

### Post harvest technology

Cardamom seeds stored in the capsule form assured best germination percentage.

Technology for small scale processing of cocoa beans was standardised and incorporated in the package of practices recommendations. The mini-box and mini-basket methods of fermentation suitable for small scale cocoa farmers were further modified.

Methods were standardized for utilization of cashew apple for the production of alcohol, wine and vinegar. Cashew apple juice can be utilized for preparing soft beverages like squash. Cashew apple juice blended with lime juice proved to be a beverage of better quality.

#### Farm machinery

The Agricultural Engineering workshop fabricated a garden tractor with mould board plough, cultivator, bund former & other attachments and successfully tested them under garden land conditions.

A prototype pumping system consisting of a self-propelled platform and two 5 HP pumpsets, developed at the workshop proved to be a successful and economic harvester of aquatic weeds, especially *Salvinia*.

#### Farm economics

The cost of cultivation of high yielding and traditional varieties of rice in Palghat, Trichur and Alleppey districts were worked out. Net cost of cultivation per hectare in the three districts were:

District	High yielding Varieties	Traditional varieties
Palghat	Rs. 1363	Rs. 1401
Trichur	Rs. 1673	Rs. 1501
Alleppey	Rs. 2547	Rs. 2743

The benefit-cost ratio were:

District	High yielding varieties	Traditional varieties
Palghat	2.18	1.55
Trichur	1.64	1.14
Alleppey	1.32	1.17

Economic analysis of sugarcane cultivation revealed that the cost-benefit ratio for the planted crop is 1.72, while that for first ratoon crop is 1.59.

### VETERINARY AND ANIMAL SCIENCES

#### Cattle and buffaloes

The post natal growth and development of the reproductive organs, onset of spermatogenesis and semen ejaculation were found to be delayed in the cross bred bulls, as compared to the pure bred exotic bulls. Quality of semen and freezability rate of spermatozoa improved with the advancement of age of the bull indicating that these characters stabilize only at a period later than the actual attainment of puberty.

Service period and calving interval could be considerably reduced with out affecting the reproduction efficiency and milk yield by breeding cows at 45 days post-partum. The cows gaining in weight during post partum period took significantly shorter interval for expression of oestrus than those losing.

Jersey x Zebu and Brown Swiss x Zebu cross breeds attained peak yield by  $44.75 \pm 1.23$  days and  $49.88 \pm 3.06$  days, respectively.

Infertile and sterile cows and heifers could be brought into lactation successfully by injecting reproductive hormones.

Ling formula  $TS = 0.25 + 1.21D + 0.66$  was found to be most suited for estimation of total solids content of milk with varying percentages of fat.

Investigations on the microbial aetiology of abortion indicated the prevalence of Leptospirosis and Burcellosis.

The loss due to transit and off feed for 30 hours was found to be less in buffaloes than in cattle.

The percentage of bone was higher in buffaloes than in cattle. Buffaloes have proportionately heavier fore-quarter, hind quarter, skin, kidney and heart than cattles.

Long term feeding of growing calves with a concentrate ration containing 25 percent coir pith proved economical without any deleterious effects on the growth.

#### **Goats**

Genetic group of goats had significant effect on post colostral peak.

Kids which died during the first two months had significantly lower immunoglobulin level.

In cross bred goats, the average age at puberty was found to be 229 days, average weight 13.6 kgs, length of oestrous cycle 20 days 22 hrs and the duration of oestrous 52 hrs.

#### **Poultry and ducks**

The additional albumen fraction seen in hens' egg in comparison to ducks' egg had a mobility of +2 cm. Albumen content of eggs was not influenced by season.

Even the fresh chicken eggs produced during the summer showed poor internal egg quality.

Common feed ingredients, except tapioca, contained fairly high concentration of manganese.

Cross breeding of desi ducks with Khaki Campbell males resulted in off springs with economic traits.

#### **Pigs and other animals**

It was observed that higher the inbreeding co-efficient, lesser were the litter size and the litter weight, in large white Yorkshire pigs.

In the ration of growing and finishing swine, dried tapioca chips can be added to a level of 40 percent in place of concentrate cereal grains.

Indigenous pigs reared under farm conditions from birth exhibited better feed efficiency and growth rate than the village stock. These pigs born and brought up under ideal conditions compared well with other improved varieties of pigs.

Frog leg trimming wastes can be effectively utilized for economic pig rearing.

#### **Artificial insemination and animal reproduction**

Antibiotic therapy of uterus, 24 hrs after artificial insemination improved the breeding efficiency of cows.

Progesterone administration 5-10 mg intramuscular immediately after artificial insemination improved conception rate.

Goat milk extender was found to be unsuitable for preserving buck semen beyond 24 hrs of storage at 5°C.

#### **Animal diseases**

Sub-clinical pathological changes observed in the reproductive organs of goats revealed the role of aflatoxins in causing reproductive failures.

A technique was developed for demonstrating T cells in the peripheral blood of animals.

Indoplanorbis and Lymnea species were identified as intermediate hosts for *S. spindalis*.

Mebendazole at a dosage of 100 mg/kg was found to be effective against strongyle infection.

Casoni's test using standardized antigen containing low nitrogen content was found useful in the diagnosis of hydatidosis.

*E. coli* and *Salmonella* sp. were identified as aetiological factors of enteritis in goats.

The serological survey in Kerala indicated the prevalence of infectious bovine rhinotracheitis and infectious pustular vulvo-vaginitis.

Adult ducks were found to act as carriers of RD virus.

#### **FISHERIES**

Studies for identification of suitable varieties of fishes which can be cultured along with rice in paddy fields revealed four species, *Cyprinus carpio*, *Etroplus suratensis*, *Orphronemus goramy* and *Tilapia mossambica* as suitable for culturing along with rice.

Etroplus, mrigal and other carps fed on pig dung collected from the piggery unit at CRS, Kumarakom produced 178 kg/ha yield compared to 50 kg/ha yield obtained from the pond where coconut cake and rice bran were fed.

Adaptive trials on "simultaneous farming of fishes and prawns along with paddy", conducted at Ramankari in Kuttanad, have shown that Catla and Mrigal attained size of 370 mm and 1.2 kg, and 350 mm and 330 g respectively within a period of four months after release.

## EXTENSION EDUCATION

Dr. V. S. S. Potti continued as the Director of Extension during the year under report. The strength of scientific and supporting staff in the Extension Wing is furnished in Appendix III.

## TRAINING PROGRAMMES

Two training units functioned in the University, one at the Headquarters and the other at the Vellayani campus. Thirty one training programmes were conducted during the year. Personnel of the Department of Agriculture (Jr. Agrl. Officers & District Level Officers) were given training in rice production technology, microbiological techniques, plant protection, disease & pest surveillance, pulses & oil seeds development, fungal & viral diseases and pests of pulses, fertilizer analysis, etc. A six-month training course was conducted for the Agricultural Demonstrators. Under the "T & V" programme, the Village Level Workers were given six-month training at the College of Agriculture, College of Horticulture and Institute of Agricultural Technology. The Fieldmen deputed from the Union Territory of Lakshadweep were trained in agricultural aspects. The para-Veterinary staff from Lakshadweep were trained in poultry management, clinics and farm management. The Kerala Agricultural University teachers were trained in the statistical methods, use of audio-visual aids, etc. Rural Development Officers of the State Bank of India and the Branch Managers of the Catholic Syrian Bank were given training in production technology and other agricultural aspects. Rural women were given training in fruit & vegetable preservation, household arts etc. Four hundred NCC cadets were exposed to Agriculture and allied aspects in a training programme. In the field of Veterinary & Animal Sciences, the training programmes included diagnostic techniques of bacterial and virus diseases of animals, Veterinary Public Health, diagnostic techniques and treatment of infertility/sterility problems, assessment of nutritional status of animals by serum analysis, etc. Refresher and in-service training programmes were also conducted for Asst. Directors of the Dairy Development Department, Dairy Farm Instructors, Livestock Assistants, etc. Released defence personnel were given training in dairying, poultry farming etc.

## FARM ADVISORY SERVICE & SEMINARS

The Farm Advisory Service enabled the farmers to discuss and solve their technical problems. The specialists of the University were also exposed to various problems of the farmers. Thirty-three district level seminars were arranged for achieving the above objectives. The

questions and answers were cyclostyled and the books distributed to the participating farmers.

#### WORKSHOP ON PACKAGE OF PRACTICES & EXHIBITIONS

Workshop on package of practices for crops was conducted on 11th & 12th March, 1981.

The Kerala Agricultural University actively participated in the Trichur Pooram Exhibition. The University stall was awarded the First prize. Twenty three mini-exhibitions were organised in connection with the Lab-to-Land programme and district level seminars.

#### UNIVERSITY PRESS

During the period under report, nearly 200 different items of work were completed. These included text books, periodicals, technical bulletins, college magazines, Research Report (1978-79), Codified List or Research Projects (1980), Annual Report (1979-80), Budget, Budget speech, lessons for the correspondence courses, registers, forms etc. A new HMT printing machine has been ordered for the press.

#### RADIO PROGRAMMES, CORRESPONDENCE COURSE ETC.

Information support was provided to the farmers through "Agricultural Science News", "Instructions to farmers and extension workers", "Talks", "Interviews", "Farm School on AIR", etc. organised by the All India Radio. Research findings from the Kerala Agricultural University and other sources were high-lighted in these programmes.

Correspondence courses on "profitable poultry farming" and "coconut cultivation" with 16 and 18 lessons, respectively were started simultaneously.

#### PUBLICATION UNIT

Besides publishing regular periodicals, a number of free and priced publications were brought out which included:

- ലാഭകരമായ കോഴിവളർത്തൽ
- കായിക പ്രവർദ്ധനം
- പോഷകത്തോട്ടം
- കശുമാവ്
- വീട്ടുവളപ്പിലെ പൂത്തോട്ടം
- നെല്ല്
- തെങ്ങ്
- ശുദ്ധജല മൽസ്യക്ഷേപി
- ലവണജല മൽസ്യക്ഷേപി
- ഗവേഷണോപഹാരം (നെല്ല് ഗവേഷണ കേന്ദ്രം-വൈറില)
- തലയോട്ടിലെ കാൻസർ
- കൃഷിവിജ്ഞാന കേന്ദ്രം
- കോഴിവസന്ത

വിള ഉദ്പാദനം  
സസ്യ സംരക്ഷണം  
കാർഷിക രസതന്ത്രം  
കാർഷിക വിളകൾ

‘ടി ആൻഡ് വി’ നോട്ട്

Rice Research Station, Kayamkulam  
Kerala Agricultural University

Kerala State Co-op. Bank Diamond Jubilee Endowment Lectures.

#### VILLAGE ADOPTION PROGRAMME

Under the village adoption programme, the University provides leadership for the overall development of the adopted villages. The programme also aims at building up close relationship between the University and the farming community to transfer the recently developed technologies to the farmers, and at getting feed back of field problems to the University Scientists for finding solutions. The University has adopted twelve villages. An intensive drive has been made during the year by distributing seeds, seedlings, fertilizers, goats, chicks, etc. and by organising training camps, group discussions, field days, mini-exhibitions, field visits, etc. Sixty farmers of the Kozhukully village were taken on a study tour of the College of Horticulture, College of Veterinary & Animal Sciences and the nearby farms.

#### T & V PROGRAMME

The Agricultural Demonstrators deputed from the Department of Agriculture were trained at three centres namely, the College of Horticulture, the College of Agriculture and the Institute of Agricultural Technology. During the first four months of the six-month training, theory classes on different subjects were taken. The remaining two months were utilised for imparting practical training on crop production technology. Work experience programme in the cultivation of rice, vegetable, etc. also formed part of the practical training.

Monthly workshops were conducted to provide technical information to the Subject Matter Specialists with reference to the calendar of operations, to provide guidance in the preparation of lessons for the fortnightly training sessions for the Village Level Workers and to provide channel for the exchange of information and feed back of field problems. Monthly workshops were conducted at the College of Agriculture for Trivandrum and Quilon districts and at the Rice Research Station, Moncompu for Alleppey and Kottayam districts.

#### KRISHI VIGYAN MELA AND SEMINARS

Four Krishi Vigyan Melas and Seminars were conducted at Pilicode, Panniyur, Vyttila and Moncompu. In connection with the Silver Jubilee Celebrations of the College of Agriculture and the College of Veterinary & Animal Sciences, Kissan Melas along with exhibitions were organised.

## KRISHI VIGYAN KENDRA

Twenty four training courses were conducted on eight different aspects. Three hundred and eighty five farmers were trained during the year. In addition, training course on "pest surveillance" for the Agricultural Demonstrators, 'rice production' to the Officers of the Agriculture Department and field training to the final B. Sc. (Ag.) students of the College of Agriculture were the other activities of the Krishi Vigyan Kendra.

## LAB-TO-LAND PROGRAMME

Seven hundred and fifty families were selected for assistance under the lab-to-land programme. Extra inputs upto Rs. 465/- per family were provided. A lab-to-land manual was prepared for the guidance of the implementing Officers. An interdisciplinary team of 53 University Scientists was directly involved in the transfer of technology.

## NATIONAL DEMONSTRATION PROJECT

The project envisages laying out demonstrations to convince the farmers the production potentialities of every unit of land in their farm by following the latest agro-techniques and management practices. During the year, 25 demonstrations were laid out: paddy-pulse cropping pattern in eight, tapioca-groundnut pattern in seven and mixed farming system in ten units.

## DRY FARMING SCHEME

The Scheme envisages the formulation of suitable crop sequences for the drought prone Kozhinjampara-Eruthiampathy area of Chittoor Block in Palghat district. Relay cropping of cotton ten days before the harvest of groundnut, relay cropping of tapioca one month after the sowing of groundnut, raising of paddy (Annapoorna or Suvarnamodan) under delayed monsoon conditions and planting tapioca alone in April-May were found to be suitable for the area.

## NATIONAL SERVICE SCHEME

The Director of Extension continued to be the National Service Scheme Programme Co-ordinator during the period. National Service Scheme units functioned in the College of Agriculture with 225 volunteers, the College of Horticulture with 175 and volunteers and the College of Veterinary & Animal Sciences with 200 volunteers. The National Service Scheme volunteers took active part in various programmes like kisan melas, karshaka seminars, exhibitions, village adoption, cleaning campaigns, blood donation, Vanamaholsava, training of rural youth and women, etc. The Vellayani unit continued to maintain a Community Centre at Keezhoor. A samithy called National Service Scheme Rravarthaka Samithi was formed to help their activities.

The unit of the College of Horticulture organised a medical camp in the harijan colony at Kallayi. The volunteers advised the villagers to eradicate dowry and other social evils.



The unit of the College of Veterinary & Animal Sciences organised sterility camps for the examination of animals and for prescribing remedial measures. Vaccination campaigns for rabies and Ranikhet disease were also organised.

The units in the three Colleges organised special camps. The theme of the camp was 'youth for rural reconstruction'. The Vellayani unit constructed a one-kilometer road connecting the College of Agriculture road and Venganoor road. About 300 families were benefited by the gesture. A socio-economic survey was also conducted in the neighbouring area. The unit of the College of Horticulture constructed a one-kilometer road from NSLP School, Madakkathara to the Cashew Research Station, Vellanikkara. Socio-economic surveys were conducted in the Madakkathara village, Mullakkara harijan colony and Kallayi harijan colony. Collection of soil samples, bunchy top eradication, rodent control, distribution of vegetable seeds, etc. were the other items during the special camp. The unit of the College of Veterinary & Animal Sciences utilised the opportunity of the special camp for repairing three roads, for undertaking Ranikhet vaccination, etc. An elephant show was conducted at the Municipal Stadium.

#### ENGINEERING WING

Sri. N. Sivathanu Pillai was the Director of Physical Plant. Construction of the Meat Technology building at Mannuthy, the Teachers Hostel at Vellayani and five Type VI residential quarters at Mannuthy were the major items of work completed during the year. Items under construction included the Radio-isotope Laboratory, the Assoc. Deans' quarters, two quarters for Assoc. Professors and six quarters for Professors at the Main Campus. Consequent on the shifting of the College of Fisheries, construction of semi-permanent sheds for the College at Panangad was also taken up.

#### FINANCE

Sri. P. Rajagopala Pillai continued as the Comptroller till 7-4-1980. Sri. E. Damodara Marar, Registrar held full additional charge of the post of Comptroller during the period from 8-4-80 to 15-6-80. Sri. N. M. Abdul Kadir took charge as the Comptroller of the University on 16-6-1980 and continued during the year.

#### ESTATE

Sri. T. Ibrahimkutty continued as the Estate Officer. A quantity of 44,004.83 kg of finished rubber was produced during the year. The total receipts from the estate amounted to Rs. 7,12,524.32.

## CHAPTER I

# General Administration

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The Kerala Agricultural University came into existence with effect from 24th February, 1971 under the Kerala Agricultural University Act, 1971 (Act 33 of 1971).

The Main Campus of the University is located at Vellanikkara. The University also has four other teaching campuses at Mannuthy, Panangad, Vellayani and Tavanur. The College of Fisheries was shifted to its permanent location at Panangad near Cochin. In addition to these, there are 23 Research Stations distributed throughout the State. The total area of land under the University is 1910.24 hectares, which includes 1.24 hectares of land taken advance possession of during March, 1980 at Panangad for the establishment of the College of Fisheries. It is proposed to acquire a total area of 30 hectares for the development of the Campus for the College of Fisheries, for which sanction has already been accorded by the Government. The University is in possession of 101.1 ha of land in Pudevaypu for the establishment of a Research-cum-Instructional Farm. A map showing the Campuses and Research Stations under the University is appended.

The main construction works of the University are undertaken with the financial assistance of the I. C. A. R. The University also received liberal financial assistance from the State Government for its planned growth and smooth functioning. Financial assistance is also received from outside agencies under the Kerala Agricultural Development Project, National Agricultural Research Project, National Agricultural Extension Project (T&V) etc.

### **Officers of the University and the administrative set up**

Chancellor	: Smt. Jyothi Venkitachellam Governor of Kerala
Pro-Chancellor	: Smt. K. R. Gouri, Minister of Agriculture and Social Welfare
Vice-Chancellor	: Sri. N. Kaleeswaran
Registrar	: Sri. E. Damodara Marar
Comptroller	: Sri. N. M. Abdul Kadir (from 16.6.80)

Director of Physical Plant	: Sri. N. Sivathanu Pillai
Librarian	: Vacant
Deans of Faculties	
Agriculture	: Dr. N. Sadanandan
Fisheries	: Dr. M. J. Sabastian
Vety. & Animal Sciences	: Dr. M. Krishnan Nair (from 3.9.1980) Dr. A. Venugopalan, Prof. (R. C- Vet.) held additional charge of the post till 3.9.80
Director of Students Welfare	: Vacant
Director of Research	: Dr. P. C. Sivaraman Nair (from 9. 3. 1981) Prof. P. N. Pisharody, Project Co-ordinator (Rice) held additional charge of the post till 9. 3. 1981.
Director of Extension	: Dr. V. S. S. Potti

The administrative hierarchy of the University begins with the Governor of Kerala as its Chancellor. The Minister for Agriculture is the Pro-Chancellor. The Vice-Chancellor is the principal, Executive and Academic Officer of the University. He is the Ex-Officio Chairman of the General Council, the Executive Committee and the Academic Council.

The Vice-Chancellor is a full time Officer of the University and the immediate overall control is vested with him. Administrative control of the University is vested with the Registrar. The Comptroller looks after the preparation of the budget, statement of accounts and audit. The research administration, the extension activities and public relations are handled by the Director of Research and the Director of Extension, respectively. The Director of Physical Plant is the custodian of all properties and he is responsible for the construction works, maintenance of buildings, purchase of vehicles etc. The resident teaching, professional competence evaluation, improvement of curriculum, etc. are managed by the Deans of the Faculties.

#### **Authorities of the University**

The statutory authorities of the University are the General Council, the Executive Committee, the Academic Council, the Faculties, Board of Studies of Faculties and the Finance Committee.

The list of members of these authorities is given in Appendix I.

#### ***The General Council***

The General Council is the supreme authority of the University. The Council comprises of 18 Ex-Officio members, 18 elected members, 17 nominated members, representatives of the other three Universities in Kerala and an I. C. A. R. nominee. The Council meets once in four

months and is reconstituted every three years. The Council was reconstituted on 31.1.80, excluding the positions of the representatives of Kerala, Calicut and Cochin Universities and representatives of the Legislative Assembly. The above positions were filled up after 1.4.1980. The General Council held two ordinary meetings (31st July, 20th and 21st Nov., 1980) and two special meetings (28th June, 1980 and 28th Feb., 1981) during the year under report, besides the annual meeting on 27th & 28th March, 1981. The Council at its meeting held in July, 1980 approved the starting of a four-year degree programme in Co-operation & Banking under the KAU from the academic year 1981-82. Other important decisions included the constitution of an Assurance Committee to monitor the implementation of the decisions of the General Council, grade promotions to the teachers based on length of service and an assessment, and organisation of district level seminars with the co-operation of the Department of Agriculture.

#### *The Executive Committee*

The Executive Committee is the chief executive body of the University. The Committee consists of the Vice-Chancellor, three Ex-Officio members, six elected members and the member representing the I. C. A. R. in the General Council. The Executive Committee held eleven ordinary meetings and one special meeting during the period under report.

#### *The Academic Council*

Maintenance of standards of instruction, education and examinations within the University is the responsibility of the Academic Council. The Academic Council also exercises such other powers and performs such other functions conferred or imposed upon it by Statutes.

The Academic Council met four times during the year under report. The important decisions of the Council pertained to:

- Sanction of merit scholarships to the students of the diploma course

- Establishment of a P. G. Centre of Agrl. Engineering

- Starting of a Diploma course in Agrl. and Rural Engineering from 1980-81 onwards

- Starting of the U. G. programme in Co-operation and Banking from 1981-82 onwards

- Approval of the revised syllabi for the first year B. Sc. (Ag.) and B. Sc. (Hort.) programmes

- Starting of Ph. D. programmes in Microbiology, Animal Reproduction and Poultry Science in the Faculty of Veterinary and Anima Sciences

#### *Board of studies*

Board of studies is constituted for each Faculty. The Boards of studies look into the academic standards in the respective Faculties.

### *The Finance Committee*

The Finance Committee consists of the Vice-Chancellor, Finance Secretary to the Government of Kerala, the Comptroller and two members chosen by the Executive Committee—one from among the non-official members and the other from among the Ex-Officio members.

### *The Sub-Committees*

The Sub-Committees mentioned below continued to function during the period under report.

Research Council

Faculty Research Committees (Agriculture, Vet. & Ani. Sciences)

Variety Evaluation Committee

Selection Committees

Student's Welfare Committee

Committee for deputation of academic staff

Selection Committees for post-graduate courses

Selection Committees for under-graduate courses

Sports Board

Extension Advisory Committee

Planning and Development Committee

Statute Sub-Committee

The list of members of the various Sub-Committees are given in Appendix II.

### **University Organisation**

There were three Faculties, the Faculty of Agriculture, the Faculty of Veterinary and Animal Sciences and the Faculty of Fisheries. The Kerala Agricultural University act also envisages the establishment of Faculties of Basic Sciences and Humanities, Co-operation, Home Science, Forestry, Agricultural Engineering and Technology etc.

The Research Council, the Research Advisory Committee, the Faculty Research Committees and the Project Co-ordination Committees are the bodies responsible to formulate the research programmes of the University. The Research Council is constituted by giving representation to the Scientists of other Universities like University of Agricultural Sciences (Bangalore), Tamil Nadu Agricultural University (Coimbatore) and Andhra Pradesh Agricultural University (Rajendra Nagar) and the representatives from the sister Universities of Kerala. The Research Council was reconstituted on 1.1.1981.

The Extension Advisory Committee renders advice on Extension Education activities of the University. The activities are organised through the Director of Extension.

### **Faculty improvement**

The staff members were provided with opportunities to acquire higher qualifications by granting deputation, study leave and leave for study

purpose. Staff members were also sent for short training courses in various specialisations and for attending seminars and symposia organised by different Scientific Agencies/ICAR Institutes.

#### Officers' meeting

Meetings of the Deans, Directors, Associate Dean, Registrar and Comptroller are held periodically, with the Vice-Chancellor presiding, to discuss important administrative matters of the University. One such meeting was held during the year. The delegation of powers to the Associate Director, Regional Research Station, Pilicode was approved in the meeting. The Professors/Officers i/c of Research Stations were delegated with powers to maintain and repair tractors and power tillers. It was decided that the job opportunities of the graduates be assessed before commencing a graduate course in Agricultural Engineering.

#### Student admissions

The number of applications received for the different courses, the number of admissions made and the marks secured by the last candidate under open merit and various reserved quota were as follows:

##### *Undergraduate degree courses*

Details	B. Sc. (Ag.)	B. Sc. (Hort.)	B. V. Sc. & A. H.	B. F. Sc.
Valid applications	1308	484	481	224
Students admitted (Including nominees)	128	40	76	30
Marks secured by the last candidates under				
Open quota	400*	383*	369*	368*
SEBC I	363	360	345	335
SEBC II	335	333	316	327
SEBC III	360	318	311	313
SEBC IV	366	349	309	341
SEBC V	344	318	351	317
S. C.	261	250	209	276
S. T.	180	—	199	257
T. C.	397	382	366	366
Malabar	383	372	361	362

\* Out of a total 515

Pre-degree Part III	450
B. Sc.	20
N. S. S.	5
Social Service	5
Sports	20
Ex-Service	15
<b>Total</b>	<b>515</b>

*Undergraduate diploma courses*

Details	Diploma in Agrl. Sciences	Diploma in Agrl. and Rural Engg.
Valid applications	868	477
Students admitted (including nominees)	50	31
Marks secured by the last candidates under		
Open quota	321*	365*
SEBC I	307	314
SEBC II	270	288
SEBC III	253	278
SEBC IV	288	230
SEBC V	304	345
S. C.	270	253
S. T.	258	239
T. C.	314	350
Malabar	319	349

\* Out of a total 600 for S. S. L. C.

*Postgraduate degree courses*

Details	No. of applications	No. of admissions
M. Sc. (Ag.) Agronomy	} 232	13
Agri. Botany		7
Soil Science & Agri. Chemistry		2
Agri. Entomology		5
Agri. Extension		6
Plant Breeding		9
Plant Pathology		6
Agri. Economics		6
Agri. Statistics		5
Agri. Engineering		4
M. Sc. (Hort.)	40	14
M. V. Sc.	22	18
Ph. D. Agriculture	24	11
Horticulture	8	6
Vet. Science	1	—

*Postgraduate diploma courses*

Details	No. of applications	No. of admissions
Natural Rubber Production	3	3
Soil Science	7	7
Plant protection	3	3
Land & Water Resources		
Development and Management	5	5
Veterinary and Animal Sciences	12	12

The number of students who obtained degree/diploma during 1980-81 was as follows:

Details	No. of students/getting degree/diploma
<i>Undergraduate degree programmes</i>	
B. Sc. (Ag.)	98
B. Sc. (Hort.)	28
B. V. Sc. & A. H.	40
<i>U. G. diploma programme</i>	
Diploma in Agrl. Science	42
<i>Postgraduate degree programmes</i>	
M. Sc. (Ag.)	28
M. Sc. (Hort.)	7
Ph.D Agriculture	4
Veterinary Sciences	2
<i>P. G. diploma programmes</i>	
Natural Rubber Production	7
Vety. & Animal Sciences	12

**Other matters**

Based on the discussions between the Vice-Chancellor and the representatives of the different service organisations, general guidelines were framed for the transfer of non-teaching staff among the various Stations of the University. The University issued orders granting several benefits to its personnel working in remote Stations. These included the sanction of 5 to  $7\frac{1}{3}\%$  of the basic pay as outstation allowance, sanction of one additional increment to those working in the remote stations continuously for more than three years, sanction of further additional increments to them at the rate of one increment for every two years in the same station, permission to retain the quarters at the old stations for those who prefer to retain their families at the old stations and retention of their names in the pending list for allotment of quarters. The University sanctioned one additional increment to its Class IV employees who were not benefitted by the parity arrangements as on 1.1.1976. ●



## CHAPTER II

# Education

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### THE COLLEGE OF AGRICULTURE, VELLAYANI

The College of Agriculture, Vellayani (11km from Trivandrum) was started in the year 1955 with the object of imparting scientific agricultural education leading to the Bachelor's degree in Agriculture, B. Sc. (Ag.). The 240-hectare campus is surrounded on three sides by the Vellayani lake. Consequent on the formation of the Kerala Agricultural University in 1972, it became one of the constituent colleges of the University. The trimester-course system of instruction is being followed.

#### Departments

This college continued to be headed by the Dean, Dr. N. Sadanandan, under whom the following 12 departments functioned:

Agronomy, Agricultural Botany, Plant Breeding, Agricultural Chemistry, Agrl. Entomology, Agrl. Extension, Agrl. Economics, Agrl. Statistics, Plant Pathology, Agricultural Engineering, Horticulture and Animal Husbandry.

The first 11 departments were under the Faculty of Agriculture, while the Department of Animal Husbandry was under the technical control of the Dean, Faculty of Veterinary and Animal Sciences. There was an Instructional Farm attached to the College of Agriculture.

#### Staff

There were nine Professors, 23 Associate Professors, 30 Assistant Professors and 29 Junior Assistant Professors attached to the different departments. Sri. M. S. Thomas, Assistant Professor (Ag. Engg.) was deputed to the State Department of Agriculture. Sri. E. J. Thomas, Professor of Agrl. Statistics expired during the year.

Sri. Jacob John (Assoc. Professor of Agrl. Engg.) and Sri. G. Ouseph (Lab. Attender) were granted five years leave for taking appointment elsewhere. Sri.K. Srinivasan, (Professor & Head of the Department of Horticulture, Sri. J. B. Rose (Assoc. Professor & Head of the Department of Animal Husbandry), Dr. V. Gopaldaswamy (Assoc. Professor of Agrl.

Chemistry) and Sri. N. Kesava Pillai (Peon) retired from service during the year. The list of scientific and supporting staff is given in Appendix IV.

*Faculty improvement programme*

Smt. P. Saraswathy, Assoc. Professor (Agrl. Statistics) and Sri B. Babu, Asst. Professor (Agrl. Extn.) continued to be on deputation for their Ph. D. programme. Sri. B. Rajagopalan rejoined on completion of his Ph. D. programme. Sri. G. Sreekantan Nair (Assoc. Professor of Horticulture) was granted study leave for undergoing Ph. D. course, while Sri. B. Mohankumar, Sri. P. V. Balachandran, Smt. Sreedevi, Sri. Jayaraman, Sri. R. Muraleedhara Prasad, Sri. Abdul Vahab, Sri. Sivaprasad and Smt. K. K. Sulochana were granted leave for study purpose.

*Seminars, workshops, extension lectures, training programmes, correspondence courses, etc. conducted*

The following training programmes were conducted during the year:

- Advanced training in Plant Protection for the District Agrl. Officers
- A training programme on microbiological techniques for the Junior Agricultural Officers
- Central sector state level minikit training programmes for kharif and rabi, for the Agricultural Officers
- T & V training for Agricultural Demonstrators
- One day orientation training on ANP to the Medical Officers
- Training in household arts for rural women
- All India training cum-seminar on post harvest technology of roots and tubers to the women functionaries
- Training in fruit and vegetable preservation

Dr. G. Sivasankar, Coordinator, National Seeds Project, UAS, Bangalore and Sri. D. C. Joshua, Scientific Officer, BARC, Bombay gave Extension Lectures on "Genetic improvement of pulses" and "Use of radiation on crop improvement", respectively.

*Seminars, workshops etc. attended by the staff*

Sri. K. P. Madhavan Nair, Associate Professor of Agronomy attended the India/FAO/Norway seminar in maximising fertilizer use efficiency at New Delhi. Dr. C. Sreedharan, Professor of Agronomy attended the 12th annual workshop of AICARP and the 9th workshop of Fertilizer scheme. Sri. G. Raghavan Pillai, Associate Professor of Agronomy attended the annual workshop of AICP for research on forage crops at Ranchi. Dr. John Kurian attended the third workshop of AICRP on nematode pests of crops and the third All India Nematology symposium at Coimbatore. A seminar on rice pest management held at Coimbatore was attended by Dr. John Kurian, Dr. A. Visalakshi and Dr. D. Dale,

Associate Professors of Entomology. Dr. P. Padmaja, Associate Professor of Agri. Chemistry participated in the 45th annual convention of the Indian Society of Soil Sciences at Karnal. The National seminar on ginger and turmeric held at Calicut was attended by Sri. P. Sethumadhavan, Professor of Horticulture, Sri. G. Sreekantan Nair, Associate Professor of Horticulture and Sri. B. K. Jayachandran, Asst. Professor of Horticulture. Sri. M. Abdul Vahab attended the National Seminar on tuber crops held at Coimbatore.

#### *Publications*

Publications made by the staff have been listed in Appendix V.

#### **Academic programme**

In addition to the B. Sc. (Ag.) course, M. Sc. (Ag.) and Ph. D. courses were offered in the departments of Agronomy, Agricultural Botany, Agricultural Chemistry Plant Breeding, Agricultural Entomology and Plant Pathology. The Department of Agricultural Extension offered M. Sc. course. Two new PG diploma courses in Plant Protection and Soil Science were started during the year. Nine Officers from the Department of Agriculture and one from the private sector joined these courses.

#### *U. G. programme*

Details of student strength of the year under report are given below:

Class	Boys	Girls	Total
I year	37	41	78
II year	19	35	54
III year	31	21	52
IV year	61	35	96
<b>Total</b>	<b>148</b>	<b>132</b>	<b>280</b>

Eighty seven students obtained their B. Sc. (Ag.) degrees during the year.

#### *P. G. programmes*

Course & Class	Boys	Girls	Total
M. Sc. (Ag.)			
I year	26	12	38
II year	21	17	38
Ph. D.			
Junior	7	4	11
Senior	12	7	19
<b>Total (PG)</b>	<b>66</b>	<b>40</b>	<b>106</b>

Fifty two students qualified for their post-graduate degrees.

### *Outside students*

A total of 32 students from outside the State were undergoing training in this College.

### *Practical training programmes*

With a view to imparting practical know how and confidence in tackling field problems, work experience programme was instituted for the B. Sc. (Ag.) students. This is distributed over the four-year period of the U. G. programme. Accordingly, the first B. Sc. (Ag.) students raised tapioca (two cents each), second year students, banana (20 plants each) and the third year students, pulses and maize. The final B.Sc. (Ag.) students cultivated paddy (punja season). Groups of six students cultivated 3.84 ha of kayal land each. In addition, the students raised a crop of blackgram in the upper fields where water was scarce.

The final B. Sc. (Ag.) students were taken to various Research Stations under the University to acquaint them with the research activities of the Stations and to impart farm-training under the direct supervision of the Heads of the Research Stations. The students were evaluated by a detailed *viva voce* examination and based on the reports submitted.

Final year B. Sc. (Ag.) students were given practical field training in the Agricultural Development Projects for a period of two weeks, monitored by the Department of Agricultural Extension of the College in collaboration with State Department of Agriculture. During the training, the students were taken to IPD units under the direct guidance and supervision of the Officers of the Department of Agriculture.

### *Study tours*

The third B.Sc.(Ag.) students were taken on an all India tour during October, 1980. They visited important Research Stations and Institutions of agricultural importance, such as the Tamil Nadu Agricultural University (Coimbatore), the Sugarcane Breeding Institute (Coimbatore), the University of Agricultural Sciences (Bangalore), the Meteorological Institute (Pune), the Array Milk Colony (Bombay), the BARC (Bombay), the Indian Agricultural Research Institute (New Delhi), etc.

The final B. Sc. (Ag.) students were taken on an all Kerala tour during which they visited the important Research Stations of the KAU and the Central Institutes in the State.

### *Scholarships, awards and aids*

The following scholarships/educational concessions were awarded to the students during 1980-81 :

National merit scholarship	38
KAU merit scholarship	24
I. C. A. R. Junior fellowship	8
I. C. A. R. Senior fellowship	8
KAU fellowship to M.Sc. (Ag.) students	54
KAU fellowship to Ph.D. scholars	2
National loan scholarship	12
I. C. A. R. merit-cum-means scholarship	13
Educational concession under K. P. C. R.	33
Educational concession to SC/ST	25
Educational concession to OEC	1
Educational concession to Lakshadweep students	3
Scholarship awarded by Andhra Pradesh to OBC students	1
Stipend to students from Tripura State	10
Scholarship awarded to PG students by M/s. Excell Industries, Bombay	1
Total	233

The Aspee Foundation, Bombay instituted an endowment for awarding a Gold Medal to the final B.Sc. (Ag.) student who secures the highest mark in Entomology and Plant Pathology together, at the end of the course. Accordingly, Sri. B. Nalinakumar, Kum. K. T. Prasanna kumari and Sri. Thomas George were selected for the award of 1977, 1978 and 1979, respectively.

### *Hostel strength*

One hundred and fortyfive boys (102 undergraduates and 43 post-graduates) and 125 girls were provided accommodation in the College Hostels during the year.

### **Extra-curricular and co-curricular activities**

The College Union for the year 1980-81 functioned with Dr. N. Sadanandan as the Patron, Sri. K. Harikrishnan Nair as the President and Sri. D. Sasikumar as the General Secretary. The Union activities were inaugurated on 15-11-1980 by Prof. Samuel Mathai, former Vice-Chancellor of the University of Kerala. The Arts Club was inaugurated by Sri. Konniyur Narendranath. Sri. T. N. Jayachandran, IAS,

Special Secretary to Govt. and Director of the S.A.D.U. spoke on the occasion. The activities of the Speaker's Club was inaugurated by Dr. M. J. K. Thavaraj, Vice-Chairman, Kerala State Planning Board.

An essay competition in English was held on 7-2-1981 for selecting the winner of the Pandalam P. R. Madhavan Pillai Memorial Endowment prize for 1980. Sri. J. K. Shivan of the final B. Sc. (Ag.) won the competition.

In the essay competitions organised in connection with the World Health Day, 1981, Sri. Suresh Muthukulam of the III B. Sc. (Ag.) class won the First prize for his essay entitled "Health for all by the year 2000"

Sri. Joy Valentine, Sri. Jose T. Mathew and Sri. K. K. Narayanan represented the College in the Inter-Collegiate Science Quiz Competition organised by the Science Society of Trivandrum. They won the first prize and the Hassan Marikar Memorial Shield. In memory of late Prof. E. J. Thomas, the Students Union 1980-81 instituted an Ever Rolling Trophy for the first in interclass arts festival. The inter-collegiate volleyball, ball badminton, shuttle badminton and table tennis competitions for the year and various interclass competitions in basket ball, foot-ball, cricket, hockey, ball badminton, shuttle badminton, volleyball, kabbadi and atheletic items were held in the College. Students of the College of Agriculture participated in the inter University basketball (women), volleyball (men and women), basketball (men) competitions. The college team participated in the Dr. Seelabhadran memorial football tournament and in the Trivandrum District Hockey knockout tournament.

The activities of the NSS unit have been summarised in Chapter IV.

#### **College library**

During the year, 763 titles were added making the total stock of books to 18985 as on 31-3-1981. Subscription to 98 (43 Indian and 55 foreign) journals was continued. A book bank scheme also operated during the year. The library functioned from 8 a. m. to 8 p. m. on all working days.

#### **Instructional farm**

The Instructional Farm attached to the College of Agriculture, Vellayani, comprised of 240 ha of land including 165 ha Kayal lands and was mainly intended for imparting practical training to the students and for providing land for research activities of various departments. The main crops cultivated in the garden land portion of the Instructional Farm were;

Coconut	—	20	ha
Banana (intercrop)	—	10	ha
Mango	—	10	ha
Tapioca	—	10	ha
Fodder	—	5	ha

Vegetables	—	5 ha
Rubber	—	2 ha
Cocoa	—	1.5 ha
Guava	—	1.0 ha
Arecanut, sapota, breadfruit, jack, avocado, rambutan, clove and cinnamon	—	0.5 ha each
Other crops	—	5.90 ha
<b>Total</b>		<b>74.40 ha</b>

During the year under report, the following seeds, seedlings and other planting materials were distributed to the cultivators.

*Grafts, layers and seedlings*

Jack	5468
Mango	2910
Sapota	372
Guava	2099
West Indian Cherry	708
Lovi lovi	150
Jamba	295
Malta lemon	686
Malayan apple	105
Bread fruit	202
Banana	420
Other minor fruits	888
Clove	183
Rose	1262
Other ornamentals	1773

*Vegetable seeds (kg)*

Amaranthus	10.465
Bhindi	13.994
Chilli	6.184
Brinjal	12.814
Bittergourd	2.745
Bottlegourd	1.071
Snakegourd	0.500
Cucumber	4.008
Pumpkin	0.200
Dolichos beans	0.250
Sword beans	3.500
Winged beans	1.750
Cluster beans	6.650
Cowpea	12.864

The total coconut yield from the Instructional Farm during the year was 1,89,946 of which 12,200 and 2,861 were WCT and Komadan seednuts, respectively. The average yield of the 3092 coconut trees worked out to 61 nuts per tree. A quantity of 195.25 tonnes of fodder valued at Rs. 19,525/- was produced during the year. The expenditure of the Farm was Rs. 11,30,841.62 of which Rs. 7,34,188.30 were spent on kayal cultivation. The receipts amounted to Rs. 3,81,252.96.

The herd strength of the livestock unit was 53 (40 cows, one bull, 11 calves, one buck) and of the poultry unit, 23. A total quantity of 61,930.75 l of milk was produced during the year which was sold to the Hostels and to the members of staff. The lactation average was 5.2 litres/day. The two hundred tonnes of cattle manure produced in the unit (valued at Rs. 16,000/-) were utilized by the various departments of the college. A total number of 4390 eggs was produced by the poultry unit. The daily egg production worked out to 12. The expenditure incurred by the livestock and poultry unit was Rs 1,65,610.98 and the receipts, Rs. 1,53,350.57.

## **Other matters**

### *Silver Jubilee celebrations*

The Silver Jubilee of the College of Agriculture, Vellayani was celebrated in a befitting manner from 15-12-1980 to 17-12-1980. The celebration was inaugurated on 15-12-1980 by Sri. A. A. Rahim, M. P. Prof. A. Abraham, Chairman, Science and Technology Committee, presided over the function. Sri. A. Neelalohidadas, M. P. spoke on the occasion.

Farm labourers mela organised on the same day was inaugurated by Sri. Vakkom B. Purushothaman, Hon'ble Minister for Health. Sri. C. P. Narayanan and Sri. P. R. Francis, Members of the KAU Executive Committee spoke on the occasion. The technical session on 16-12-80 was inaugurated by Sri. T. N. Jayachandran, IAS, Special Secretary and Director, SADU and the key note address was delivered by His Grace Benedict Mar Gregorius, the Archbishop of Trivandrum. As a part of the Silver Jubilee celebrations, a session on "technological constraints in yield of rice, pepper, coconut and cashew" was conducted. Apart from the KAU Scientists, Dr. K. Gopalakrishna Pillai (Senior Agronomist, AICRIP, Hyderabad), Dr. L. Krishnaswamy (Director, Cashew Development, Cochin) and Dr. Chandy Kurian (Senior Scientist, CPCRI, Kayamkulam) presented papers. Dr. N. M. Nayar (Director, CPCRI, Kasaragod), Sri. P. Suseelan (Additional Director of Agriculture) and Dr. M. R. G. K. Nair (Retired Professor of Entomology) participated in the discussions.



On 17.1.1980, farmers mela was inaugurated by Sri. P. Mohan Das, IAS, Director of Agriculture at a meeting presided over by Sri. Sasidharan, President, Kalliyoor Panchayat. A lively discussion on various aspects of crop production was held in which farmers and experts took part. An old students meeting was also conducted which was presided over by Sri. Ashok Koshy, IAS, Managing Director, Milma. Sri. R. Balakrishna Pillai, Hon'ble Minister for Electricity inaugurated the event. Sri. M. Janardhanan Nair, Retired Director of Agriculture unveiled the portraits of former Heads of this Institution. Professor P. Kumara Pillai, Retired Principal of this Institution felicitated the First Rank holders in the B. Sc. (Ag.) course since the inception of this Institution.

In connection with the Silver Jubilee celebrations, an exhibition was also arranged for the benefit of the farmers. All the Departments of the Institution arranged the exhibits in a most informative manner depicting the latest developments in the respective fields. The exhibition was very much appreciated by the farmers and Scientists who visited the same.

#### *Visitors to the Institution*

Sri. Hariharan, Assist Meteorologist, Pune, visited this College to inspect the Meteorology unit and suggest improvements.

The ICAR review team consisting of Prof L. L. Relwani and Dr. S. D. Rai, Project Co-ordinator (Forage Research) visited this Institution and reviewed the progress of the All India Co-ordinated Project on Forage crops.

Dr. Hobert, F. Inger and Mrs. Caroline Blacknon, Museum of Natural History, Chicago, Dr. Malcolm Art and Mrs. Catherine Presine, American Museum of Natural History, New York, Dr. Edward Munyar, Florida State Museum and Dr. S. M. Nair, Head, National Museum of Natural History, New Delhi visited the College and acquainted themselves with the crops grown, research undertaken etc.

Mrs. Revina Sreenivasan, Programme Analyst (UNICEF) visited the institution to review the KEFN activities.

NARP appraisal team lead by Dr. Ramanamurthy (Retired Agrl. Commissioner) visited the College on 23rd March, 81 and held discussions with the Dean and the Heads of Departments.

#### **THE COLLEGE OF HORTICULTURE, VELLANIKKARA.**

The College of Horticulture established in October 1972, is located at Vellanikkara 10 km from Trichur, on the Trichur Palghat highway.

## Departments

Dr. P. C. Sivaraman Nair continued to be the Associate Dean till 9-3-1981, after which Dr. P. K. Gopalakrishnan, Professor of Horticulture (Coconut), KADP held full additional charge of the post. Fourteen departments-Pomology & Floriculture, Plantation crops & Spices, Olericulture, Processing Technology, Agronomy, Agrl. Botany, Soil Science & Agricultural Chemistry, Agrl. Entomology, Plant Pathology, Agrl. Economics, Agrl. Engineering, Agrl. Statistics, Agrl. Extension and Agrl. Meteorology functioned in the College.

The Kerala Agricultural Development Project, Pepper Research Scheme, Sugarcane Research Scheme, AICRP on biological control of crop pests, AICP for improvement of tuber crops, AICARP, Coconut root wilt disease project and ICAR Scheme on germplasm collection of jack fruit were being implemented in the Campus. The Instructional Farm & Rice Research Station, Mannuthy was also attached to this College.

## *Staff*

The staff consisted of the Associate Dean as the head of the Institution under whom six Professors, 13 Associate Professors, 19 Asst. Professors and nine Junior Asst. Professors worked in the various Departments. The details are furnished in Appendix IV.

## *Faculty improvement programme*

Smt. K. C. Marykutty (Asst. Professor) was granted study leave and Sri. Joseph Philip (Asst. Professor), Sri. R. Kesavachandran and Sri. Parameswaran (Junior Asst. Professors) were granted leave for study purpose for undergoing Ph. D. programmes. Sri. K. John Thomas Associate Professor of Agricultural Engineering attended the second postgraduate diploma course on water management (Engineering) at IARI, New Delhi.

Dr. P. A. Wahid attended a short training on safety aspects on the use of radio isotopes at the BARC. Sri. V. K. Gopinathan Unnithan attended a training in computer programming at the IARS, New Delhi. Sri. Mathew Jacob attended three-month training on assessment of grain, protein in quality and quantity at the NRL, IARI. Sri. R. Kesavachandran attended a one-week training programme in tissue-culture at the TNAU, Coimbatore.

## *Seminars, workshops, extension lectures and trainings conducted*

The first Annual Workshop on Agricultural Engineering and Technology in Kerala was conducted from 25-5-1980 to 29-5-1980 when an exhibition was also arranged. The College conducted various short term training programmes to farmers, gardeners, employees of commercial banks and railways, school teachers, Agricultural Demon-

strators and Agricultural Officers independently as well as under the auspice of the Directorate of Extension of the Kerala Agricultural University.

#### *Seminars and workshops attended by the staff*

Dr. P. K. Gopalakrishnan attended the Second International Workshop on winged beans at Colombo and the AICVIP workshop at Pune. Dr. M. Aravindakshan attended the International Symposium on tropical fruits at UAS, Bangalore and the seminar on banana production technology held at Coimbatore. The International Rubber Conference India 1980 (IRCIND 1980) held at Kottayam was attended by Dr. P. C. Sivaraman Nair, Dr. N. Mohanakumaran, Dr. T. V. Viswanathan, Dr. Abi Cheeran and Dr. C. K. Peethambaran. Dr. Abi Cheeran attended the International workshop on *Phytophthora*. Dr. K. M. Narayanan Namboothiri participated in the National seminar on ratoon management at the Indian Institute of Sugarcane Research, Lucknow. The national seminar on ginger and turmeric held at Calicut was attended by Dr. P. C. Sivaraman Nair, Dr. N. Mohanakumaran, Dr. T. S. Venkitesan, Dr. C. K. Peethambaran and Sri. T. Premnathan. Dr. T. S. Venkitesan attended the all India Nematology workshop and the III All India Nematology symposium at Tamil Nadu Agricultural University, Coimbatore. Dr. C. C. Abraham attended the symposium on teaching method/work experience at the UAS, Bangalore. Dr. K. V. Mamman attended the seminar on rice pest management at the Tamil Nadu Agricultural University, Coimbatore. Dr. T. V. Viswanathan attended the national seminar on genetic improvement of groundnut at the Tamil Nadu Agricultural University, Coimbatore. Dr. K. V. Peter attended the AICVIP workshop at Pune. Dr. Jose Samuel attended the ICAR scientific panel meeting in Agricultural Engineering and Judging Committee meeting of "Rafi Ahmed Kidwai Memorial Award" at New Delhi. Mr. John Thomas attended the ISAE conference at Karnal. Dr. V. Radhakrishnan attended a seminar on "Perspectives of Research in Agricultural Economics" at Coimbatore. Smt. K. A. Girija participated in two workshops sponsored by ICAR/UNICEF/NIN. Dr. P. Balakrishna Pillai attended the annual conference of the Indian Society of weed Science at Bhuvaneswar.

#### *Publications*

Publications made by the staff have been listed in Appendix V.

#### **Academic programmes**

##### *U. G. programmes*

Initially, 20 students were admitted for the B. Sc. (Hort.) degree course of four years duration. Subsequently, the annual intake was increased to 30, excluding the sponsored candidates from other States and Institutions. B. Sc. (Ag.) degree course was also introduced from 1977-78 with an intake of 50 students. The first batch of B. Sc. (Hort.)

students graduated in 1976. During 1980, 77 students were newly admitted—39 for B. Sc. (Ag.) and 38 for B. Sc. (Hort.).

The class strength was as follows:

Course & Class	Boys	Girls	Total
<b>B. Sc. (Hort.)</b>			
I year	11	27	38
II year	17	18	35
III year	19	18	37
IV year	15	20	35
Total	62	83	145
<b>B. Sc. (Ag.)</b>			
I year	21	18	39
II year	24	28	52
III year	32	21	53
Total	77	67	144
<b>Total U. G. strength</b>	<b>139</b>	<b>150</b>	<b>289</b>

The fifth batch of B. Sc. (Hort.) students (1976 admission) completed their degree programme and 29 students graduated during the year under report.

#### *P. G. programme*

An one-year PG diploma course in Land and Water Resources Development and Management was started during the year.

The strength of PG students was as given below:

Course & Class	Boys	Girls	Total
<b>M. Sc. (Hort.)</b>			
I year	7	7	14
II year	3	5	8
Total	10	12	22
<b>M. Sc. (Ag.)</b>			
I year	10	2	19
II year	14	10	24
Total	24	19	43
<b>Ph. D.</b>			
Junior	6	0	6
Senior	5	1	6
<b>PG Diploma</b>			
in NRP	3	1	4
in L & WRD & M	4	0	4
<b>Total PG Strength</b>	<b>52</b>	<b>33</b>	<b>85</b>

Six students each in M. Sc. (Hort.) & M. Sc. (Ag.) programmes successfully completed their courses during the year.

### *Outside students*

A total of 81 students from outside the State were on the rolls in this College under various academic programmes,

The details are given below:

Kenya	1
Lakshadweep	6
Pondicherry & Mahe	19
Sikkim	2
Tripura	19
Manipur	29
Andhra Pradesh	4
Tamil Nadu	1
	<hr/>
Total	81
	<hr/>

### *Practical training programme*

Besides regular practical classes, the U. G. students were given plot cultivation (5 cents) of various annual crops (tapioca, vegetables etc.) and maintenance of perennial crops (mango, sapota, guava, coconut, cocoa & spices) under the work experience programme to impart practical skill and to make them capable of tackling field problems connected with these crops. Their performance was evaluated by a *viva voce* examination and based on the practical records maintained by them. In addition, an earn-while-you-learn programme was also conducted.

### *Study tours*

The second year U. G. students were taken on tour to the agricultural stations within the State. The third years visited institutions of agricultural importance outside the State.

### *Scholarships, awards and aids*

A total of 287 students of the College availed of scholarships fellowships etc. of various types during 1980-81 as detailed below:

National merit scholarship	34
KAU merit scholarship	31
ICAR Junior fellowship	12
ICAR Senior fellowship	2
KAU fellowship	49
National loan scholarship	12
ICAR merit-cum-means scholarship	27
Educational concession under KPCR	37
Educational concession to SC/ST	43
Educational concession to OEC	7
Educational concession to Lakshadweep students	5
Stipend to nominees of Tripura/Pondicherry/ Manipur etc.	28
	<hr/>
Total	287
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### *Hostel strength*

One hundred and fifty three boys and 163 girls were accommodated in the hostels during the year.

### **Extra curricular and co-curricular activities**

Students of the College actively participated and secured prizes and recognition in activities connected with sports and games, Arts Club, Quiz Club, Social Service League and Planning Forum. These activities were undertaken under the auspice of the Students Union. In addition, they participated in the National Service Scheme, village adoption programmes, Lab to Land programmes and other extension programmes organized by the University, the details of which have been summarised in Chapter IV.

### **College Library**

The library facilities of the College were considerably improved by providing additional titles and reference items. During the year under report, 2040 new titles were added, making the total stock of books to 14,540. The College subscribed to 60 Journals. The book bank scheme was continued during the year. Under the scheme, 651 books were issued to the students. The library functioned from 8 a. m. to 7 p. m. on all working days.

### **Instructional farm**

The Instructional Farm attached to this College comprised of two units, one located at Mannuthy (38.34 ha) and the other at Vellanikkara (95.35 ha). All facilities required for imparting practical training on crop cultivation and nursery practices to the students and for research work of staff were provided from this farm. The average yield of coconut during the year was 29.7 nuts per tree, rice-2220 kg/ha, banana-708kg/bunch and pineapple-18 tons/ha. The farm maintained a nursery for production and distribution of quality seeds and planting materials to the cultivators. The following were distributed during the year:

#### *Grafts and layers*

Mango	1951
Sapota	742
Lime	514
Guava	279

#### *Seedlings*

Coconut	8461
Lime	594
Guava	410
Nutmeg	209
Clove	375
Mangosteen	83
Cocoa	1674

Krini	800
Cinnamon	256
Jack	26
Singapur jack	416
Jamba	218
Papaya	214
Banana	1000
Other minor fruits	806
Ornamental plants	6526
<i>Seeds</i>	
Paddy	217.60 kg
Amaranthus	0.27 kg
Groundnut	22.00 kg
Bittergourd	8.60 kg

#### **Distinguished visitors**

- Smt. K. R. Gouri, Hon'ble Minister for Agriculture  
 Sri. T. K. Ramakrishnan,, Hon'ble Minister for Home & Co-operation  
 Dr. K. V. Khuspe, Vice-Chancellor, Marathwada Agricultura University, Parbhani  
 Sri. Baby John, Hon'ble Minister for Education  
 Sri. Gueliani Franco, Institute of Agronomy, Florence, Itlay  
 Sri. Godfrey S. Mukubuta, Department of Agriculture, Zambia  
 Dr. K. I. Vasu, Pro-Vice Chancellor, University of Cochin  
 Prof. G. Sankara Pillai, Director, School of Drama

#### **THE COLLEGE OF VETERINARY & ANIMAL SCIENCES, MANNUTHY**

The Veterinary College was established in 1955 at Mannuthy and and it became a constituent unit of the Kerala Agricultural Unlversity in 1972.

#### **Departments**

Dr. A. Venugopalan, Professor (Research Co-ordination) was in full additional charge of the Dean until 3-9-1980 when Dr. M. Krishnan, Nair assumed charge as the Dean. The following 18 departments--Anatomy, Animal Management, Animal Reproduction, Animal Breeding and Genetics, Clinical Medicine, Dairy Science, Extension, Microbiology, Nutritron, Parasitology, Pathology, Pharmacology, Physiology, Poultry Science, Preventive Medicine, Surgery, Veterinary Public Health and Statistics functioned during the year. Two Veterinary Hospitals--one at Mannuthy and the other at Trichur along with the Livestock Farm, the Poultry Farm, the Pig Breeding Farm and the A. I. Centre served as the instructional units.

## **Staff**

The staff consisted of the Dean as the Head of the College under whom 17 Professors, 29 Associate Professors, 26 Asst. Professors and 23 Junior Asst. Professors worked in the various departments. The details of Scientists and supporting staff are furnished in Appendix IV.

### ***Faculty improvement programme***

Dr. Kurian Thomas, Dr. K. M. Alikutty, Dr. K. T. Punnoose, Dr. M. K. Rajagopalan, Dr. K. N. Muraleedharan Nair, Dr. R. Padmanabha Iyer, Dr. J. Abraham and Sri. K. L. Sunny were on deputation for higher studies. Dr. K. I. Maryamma, Dr. C. R. Lalithakunjamma and Dr. R. Sabarinathan Nair were granted study leave. Smt. P. Soudamini, Technical Assistant was granted leave for study purpose.

Dr. C. K. S. V. Raja, Professor, Department of Animal Reproduction rejoined on 5-1-1981.

### ***Scholarships and awards won by the staff***

Dr. J. Abraham, Asst. Professor, Department of Veterinary Public Health was awarded FAO/DANIDA fellowship for P. G. Diploma in Food Hygiene and Veterinary Public Health at Copenhagen. Dr. K. Rajankutty, Junior Asst. professor, Department of Surgery received ICAR award being one of the three best under-graduate students in Veterinary Science for 1978-79. Dr. Stephen Mathew, Junior Asst. Professor, Department of Animal Breeding and Genetics, received KAU merit Scholarship for PG programme for the year 1980-81. Dr. K. M. Alikutty, Professor, Therapeutics and Dr. R. Sabarinathan Nair, Associate Professor, Poultry Science received ICAR senior fellowships for Ph. D. programme.

### ***Seminars, workshops, extension lectures and training programme.***

Seminars and exhibitions, Rankihet disease vaccination for poultry and H. S. vaccination for cattle were conducted in the adopted village and other parts of the State.

Dr. M. Krishnan Nair participated in the International Scientific seminar in Australia at the invitation of the Australian Veterinary Association and conducted an International post-graduate course in Sweden sponsored by FAO/SIDA. Dr. C. Abraham Varkey attended the symposium sponsored by the Indian Society for Veterinary Surgery at Ranchi. Dr. G. Nirmalan attended the seminar on wildlife in rural development at Madras. Dr. M. Subramoniam attended the workshop on quality control of dairy products at Hyderabad and the seminar on quality control and marketing of butter and ghee at Madras. Dr. N. M. Aleyas attended the Summer Institute on production disease at PAU, Ludhiana and the scientific session of the platinum Jubilee celebrations of the Madras Veterinary College.

### ***Publications***

Publications made by the staff have been listed in Appendix V.



## Academic programmes

### *U. G. programme*

During the year, 71 students were admitted to the B. V. Sc. & A. H course. The strength of students was as follows

Course	Boys	Girls	Total
B. V. Sc. & A. H.			
New admission	56	15	71
Total (UG students)	208	46	254

Forty students graduated during the year under report.

### *P. G. Programme*

During the year, 30 students were admitted to M. V. Sc. programmes and one to Ph. D. programme.

The total strength of postgraduate students was as follows:

Courses	Boys	Girls	Total
M. V. Sc.			
New admission	23	7	30
Total (M. V. Sc.)	53	11	64
Ph. D.			
New Admission	1	—	1
Total (Ph.D).	7	3	10
Total P. G. strength	60	14	74

Seven M. V. Sc. students completed their programme during the year.

### *Outside students*

Sixty five students from outside the State were on the rolls of the College which included one each from Nigeria, Tanzania and Zimbabwe.

### *Study tours*

The fourth year B. V. Sc. & A. H. students visited institutions of academic importance outside the State. The third year undergraduate students visited the KSDPL and the Excel Glass Factory at Alleppey. The final year students visited the MPI factory, Koothattukulam and the Indo-Swiss Project, Mattupatty.

### *Scholarships, awards and aids*

The following scholarships/educational concessions were awarded to the students during 1980-81;

National merit scholarship	10
KAU merit scholarship	16
ICAR Senior fellowship	3
KAU Junior fellowship	22

KAU Senior fellowship	1
ICAR merit-cum-means scholarship	14
National merit scholarship for children of school teachers	2
Govt. of India loan scholarship	3
Fisheries community scholarship under labour welfare	1
Fund Board scholarship to students from Pondichery	2
Educational concession to SC/ST	26
Educational concession to OEC	2
Educational concession under KPCR	51
Commonwealth scholarship	1
Suboto memorial scholarship	1
Educational concession to students of Jammu and Kashmir from their Govt.	
Loan by Jammu and Kashmir Bank	30
Postmetric scholarship	10
Educational concession to Lakshadweep students	13
Educational concession to Bhutanese students	4
Educational concession to Meghalaya students	5

### *Hostel strength*

Three hundred and twelve students (270 undergraduates and 42 post graduates) were provided accommodation in the College Hostels during the year. Of these, 62 were girls.

### **Extra-curricular and co-curricular activities**

The College Union for the year functioned with the Dean as the Patron, Sri. K. P. Sreekumar as the president and Sri. John Joseph as the General Secretary. Sri. Maganbhai Barot, Minister of State for Finance, Government of India inaugurated the Students Union activities and Sri. Premji, Cine artist inaugurated the Arts Club. A clinical club was organised and was inaugurated by Prof. G. Winqvist, Director, FAO. The Literary Club was inaugurated by Professor V. Aravindakshan of Sri Kerala Varma College, Trichur. Interclass and inter-collegiate drama and quiz competitions were conducted during the year. "Mriga Samrakshana Mela" vaccination programme, sterility camp, Animal Husbandry seminar, a symposium on "Is Indian culture spiritual or materialistic" and a philatelic exhibition were organised. The students participated in the traffic week celebrations of Trichur district and arranged a farewell party to the students of the College of Fisheries. The Film and Photographic Club arranged a photographic competition and screened 16 mm films. The Students Union participated in the Silver Jubilee celebrations of the College to make it a grand success.

The participants of the earn-while-you-learn programme earned substantial amounts while learning about economic pig rearing.

KAU tournaments in shuttle badminton, table tennis, basket ball, football and athletics were conducted at the College. The students participated in the Trichur district Cricket League tournament, May day sports meet sponsored by the Trichur District Sports Council and the annual athletic and intramural games competitions of the College. A sports meet for the labourers was conducted in connection with the Silver Jubilee celebrations. Specialised coaching camps by qualified coaches in volley ball, cricket and hockey were conducted during the year under report. Ten boys and seven girls of the College represented the KAU in various inter University competitions. The college won the KAU athletics, football and shuttle tournaments.

### College library

During the year under report, 720 titles were added. Subscription to 303 Journals continued during the year. The book bank scheme was continued to be operated and 251 books were issued under the scheme. An exhibition of latest books and journals was also organised during the year.

### Instructional farms/Hospitals

#### *University livestock farm, Mannuthy*

This is one of the oldest livestock farms in the State and was established in 1921. It was transferred to the KAU in 1972 by the Government of Kerala. The stock position of the farm during the year was as follows :

	Milch cows	Dry cows	Bullocks	Other stock	Total
as on 1-4-80	113	53	4	43	213
as on 31-3-81	114	35	4	16	169

52 cows/heifers were added and 69 were culled during the year. A quantity of 2,20,526.75 litres of milk was produced during the year of which 2,00,821.05 litres were sold. The total receipts for the year was Rs. 4,99,897.57 of which milk sale accounted for Rs. 4,41,053.50. The average milk yield in the farm was 623.5 kg per day and 5.4 kg per animal per day.

#### *University Poultry Farm, Mannuthy*

The farm has an area of 5.26 ha. There were 5262 birds at the beginning of the year against 7905 birds at the end. 2,02,976 eggs were produced of which 2,01,804 eggs were sold. The egg production per day was 550. A total of 23,290 birds were sold during the year. The total receipts for the year was Rs. 2,37,279.37.

### *Pig Breeding Farm, Mannuthy*

It was established on 12-1-1965 and covers an area of two ha. The animal strength on 1-4-80 was 244 against 362 on 31-3-81. A total of 295 piglets was sold during the year.

### *Fodder Research & Development Scheme, Mannuthy*

The scheme was established in 1975. It covers an area of 47 ha of which 34.5 ha were under grass and 12.5 ha were under maize during the year. 2513 tonnes of fodder was produced during the period under report.

### *Veterinary Hospital, Mannuthy*

11,053 outpatients were treated in the hospital during 1980-81. 123 castrations and 485 operations were performed. A total of 6,296 birds were treated/vaccinated during the period. The average daily attendance was 30.

### *Veterinary Hospital, Kokkalai, Trichur*

30,524 outpatients were treated during 1980-81. 72 castrations and 286 operations were performed. Seven antirabies treatments and 317 PAR vaccinations were done. 14,373 birds were treated/vaccinated during the course of the year. The average daily attendance was 83.

### **Other activities**

The College celebrated its Silver Jubilee for four days from 3-12-80. The celebrations were inaugurated on 3-12-80 by Sri. C. Achutha Menon, former Chief Minister of Kerala in a function presided over by Sri. N. Kaleeswaran, Vice-Chancellor and addressed by Dr. C. T. Peter, former Dean. Sri. C. P. Narayanan, member, Executive Committee of KAU and Sri. K. R. Chakunny, President, Ollukkara Panchayath. Dr. P. K. Nambiar, Director of Animal Husbandry inaugurated the exhibition and Sri. Raghavan Pozhakadavil, M.L.A. released the Souvenir. Former Principals, Deans and Professors were honoured with mementoes. In the afternoon, games and sports were conducted for the alumni.

Dr. A Abraham, Chairman, Science and Technology, Govt. of Kerala inaugurated the scientific session on the second day which was attended by more than 400 delegates including Scientists from outside the State. Dr. P. G. Nair, Scientist, NDRI presented the key note address. Seven papers on animal production and six on animal health were presented.

The farmers' day was inaugurated on 5-12-80 by Dr. A. Subba Rao, Hon'ble Minister for Irrigation. The function was presided over by Sri. A. P. Udayabhanu, former Editor of Mathrubhumi and felicitated by Dr. V. S. S. Potti, Director of Extension, Dr. M. S. Sivasubramaniam, Additional Director of Animal Husbandry and Father Joseph Muttamana. Around 350 farmers from all over the State participated in the Seminar.

A colourful Farm Sports including a bullock cart race and ploughing competition was organised in the after noon. Sports for farm labourers was inaugurated in the afternoon of the fourth day by Sri. M. Vijaya-chandra Menon, Municipal Chairman, Trichur.

The valedictory function was inaugurated in the afternoon of 6-12-1980 by Sri. R. Balakrishna Pillai, Hon'ble Minister for Electricity and was presided over by Smt. K. R. Gouri, Hon'ble Minister for Agriculture. Sri. P. R. Francis, Member, Executive Committee of KAU spoke on the occasion. Prizes to the winners of the sports items and to the rank students of 1978-79 were distributed.

On all the four days, there was an exhibition showing the modern developments in the field of Veterinary and Animal Sciences. In addition, variety entertainments were organised by the College students, alumni, non-teaching staff, public and professionals.

#### **Distinguished visitors**

The following were the visitors to the Institution:

- Dr. H. Bakker, Professor, Tropical Animal Husbandry, Agri. Univ. Wageningen, Netherlands
- Dr. S. Rajamony, Director of Research (Veterinary), Tamil Nadu Agricultural University
- Dr. G. Winqvist, Course Director, Royal Veterinary College, Upsala, Sweden
- Dr. Rohbinder, Professor of Pathology, Royal Veterinary College, Sweden.
- Dr. S. C. Mohapatra, Project Co-ordinator, IVRI
- Dr. Parkinson, Secretary and Field Officer, Humane Slaughter Association, UK.
- Dr. A. Subha Rao, Hon'ble Minister for Irrigation
- Smt. K. R. Gouri, Hon'ble Minister for Agriculture
- Sri. R. Balakrishna Pillai, Hon'ble Minister for Electricity.
- Sri. Achutha Menon, former Chief Minister of Kerala
- Dr. P. K. Nambiar, Director of Animal Husbandry, Govt. of Kerala.
- Dr. M. S. Sivasubramaniam, Additional Director of Animal Husbandry, Govt. of Kerala
- Dr. P. G. Nair, Scientist, NDRI
- Dr. A. Abraham, Chairman, Science and Technology, Govt. of Kerala
- Dr. C. T. Peter, former Dean, Faculty of Veterinary and Animal Sciences, KAU

#### **THE COLLEGE OF FISHERIES**

The College and Faculty of Fisheries were established under the Kerala Agricultural University in the academic year 1979-80 as per the recommendations of an ICAR visiting team and with the approval of the Government of Kerala. The College of Fisheries was started temporarily at Mannuthy on 10-10-1979 with an intake capacity of 30 students. The

College was shifted to its permanent location at Panangad during the year. The College offers a four-year degree programme leading to the award of the degree of Bachelor of Fishery Sciences (B. F. Sc.). Out of the 30 seats available, nine seats are reserved for fishermen students, 10 seats are filled up on open merit basis and 11 seats on the basis of merit-cum-communal reservation. The trimester-course system of education is followed. Action was in progress for completing the acquisition of about 30 hectares of land in Panangad, Cochin for the permanent establishment of the College of Fisheries. The College was in possession of 101.1 ha of land in Pudevveypu for the establishment of an Instructional-cum-Research Farm.

### Departments

Dr. M. J. Sebastian continued as the Dean of the Faculty of Fisheries. The Faculty included seven Departments, namely, Aquaculture, Fishery Biology, Fish Processing Technology, Fishery Hydrography, Fishing Technology, Fishery Engineering and Management Studies.

### Staff

There were one Professor, seven Assoc. Professors, eight Assistant Professors and eight Junior Assistant Professors. The list of scientific and supporting staff is given in Appendix IV.

### Seminars, symposia etc.

Sri. C. G. Rajendran attended the workshop on Mussel farming held at Madras from 25th to 27th of September '80 organised by the Centre for Advanced Studies in Mariculture under the Central Marine Fisheries Research Institute. Sri. T. M. Sankaran, Associate Professor attended the seminar-cum-workshop on "Statistics in everyday life" organised at the College of Veterinary & Animal Sciences on 7th and 8th February, 1981.

### Academic programmes

#### U. G. programme

The strength of students under each class was:

Class	Boys	Girls	Total
B. F. Sc.			
I year	18	10	28
II year	18	9	27

#### Outside students

There were five students from outside the State undergoing training in the College.

#### Study tours

A specimen collection-cum-study tour was arranged for the second year students from 1-3-1981 to 4-3-1981. The students visited

Thangassery, Trivandrum, Kovalam, Vizhinjam, Cape Comerin and Tuticorin, collected and identified biological specimens from the inshore waters and brought preserved specimens for the College museum.

#### *Scholarships, awards and aids*

The following scholarships and educational concessions were awarded to the students;

National merit scholarship	2
Fisheries scholarship	6
Fee concession to SC/ST students	6

#### *Hostel strength*

The B. F. Sc. students were accommodated in the Veterinary College Hostels.

#### **Extra-curricular/co-curricular activities**

Dr. M. J. Sebastian, Dean, was the Patron of the College Union, Sri. K. X. Pius the President and Sri. M. V. Peethambaran, the General Secretary. The college Union for the academic year 1980-81 was inaugurated on 13-1-81 by Sri. R. C. Choudhiri, IAS, Chairman, Marine Products Export Development Authority.

#### **College library**

During the year, 716 new titles were added making the total stock of books to 4089.

#### **Instructional farm**

The Instructional Farm had a total area of 101.1184 ha of marshy land to be reclaimed as fish farm. Construction of laboratory buildings was completed and occupied on 16-1-1981.

#### **Other matters**

Dr. M. J. Sebastian (Dean) served as a member of the Selection Committee of the Agricultural Scientists Recruitment Board and in the Syllabus Review Committee of the Central Institute of Fisheries Education, Bombay.

#### **Visitors to the Institution**

The following were the visitors to the Institution during 1980-81.

Sri. R. C. Choudhiri, Chairman, Marine Products Export Development Authority.

Sri. N. P. Bhakta, Director, Pre-investment survey of Fishing harbours.

Dr. A. V. Natarajan, Director, Central Inland Fisheries Research Institute Barrackpore, West Bengal.

Mr. Atkin Olianao, Principal, Federal School of Fisheries, Lagos, Nigeria.

Dr. Panduranga Rao, Director, Central Institute of Fisheries Technology.

## **THE INSTITUTE OF AGRIL. TECHNOLOGY, TAVANUR**

The IAT is located in the Tavanur village of Malapuram district, about 7.5 km from Kuttipuram Railway Station and 12 km from Ponnani. The Institute was established in 1963 as Rural Institute and offered various Diploma and Certificate courses. The Institute was taken over by the Kerala Agricultural University on 12.12.1975 and was renamed as the Institute of Agricultural Technology in 1977.

The Institute is a training centre for farmers, students and field level workers of Government Departments in Kerala. The Institute has successfully implemented the village adoption programme and lab to land programme.

The Institute is under the direct control of the Director of Extension, Kerala Agricultural University. The Head of the Institute was designated as 'Special Officer, and as 'Director' from September, 1979. The Director of IAT, Tavanur is in the cadre of Associate Professor.

### **Courses offered**

The Institute offered two-year Diploma course in Agricultural Sciences under the trimester-course system. A seven-trimester Diploma course in Agricultural and Rural Engineering was started during the year.

### **Staff**

The teaching staff consisted of the Director (Associate Professor) as the Head of the Institution, four Asst. Professors and 15 Jr. Asst. Professors. The details of staff are furnished in the Appendix IV.

### *Faculty improvement programme*

Sri. S. Rajan (Asst. Professor) and Sri. P. C. Balakrishnan (Jr. Asst. Professor) were granted study leave during the year.

### *Seminars, workshops extension lectures and training conducted*

A Seminar was conducted on 17-3-1981 in connection with the field day of the Lab to Land programme. Two hundred and eighty six farmers and 21 Scientists of KAU and Agril. Department attended the seminar.

An exhibition of viable technologies to be transferred to farmers was also arranged. Four one-day training programmes in horticultural crops and poultry rearing were organised. Forty five farmers including agricultural labourers were benefited by the training given under the village adoption programme. A sterility camp was organised on 2-10-1981 at the Veterinary Hospital of the Institute in collaboration with the Department of Animal Husbandry.

Seventy two Agricultural Demonstrators were imparted training at the Institute under the T & V programme. Seventy trainees successfully completed the training.



### *Academic programme*

The strength of the students was as follows:

#### *Diploma course in Agricultural Sciences*

Class	Boys	Girls	Total
I year	92	4	96
II year	38	7	45
Total	130	11	141

#### *Diploma course in Agriculture and Rural Engineering*

Class	Boys	Girls	Total
I year	29	—	29

#### *Study tour*

Study tours were conducted to the various Research Stations of the Kerala Agricultural University and to the Central Plantation Crops Research Institute, Kasargod.

#### *Scholarships, awards and aids*

One hundred and thirty three students of the Institute availed of various scholarships and aids as below:

KAU merit scholarship	8
Educational concessions under KPCR	101
Educational concessions to SC/ST/OBC students	24

#### *Hostel strength*

One hundred and twenty boys and 10 girls were provided accommodation in the Institute hostel during the year.

#### **Extra-curricular and co-curricular activities**

The Students Union activities were inaugurated on 20-11-1981. The activities of the Students Union during the year included the conduct of Sports Day and literary competitions.

The Institute teams participated in the inter-collegiate tournaments in shuttle badminton, table tennis, foot ball, volley ball, ball badminton and athletics. They won the title for volley ball and three first places in athletics. The students of the Institute were members of the KAU foot ball, volley ball and basket ball teams.

A coaching camp in volley ball was conducted from 9-3-'81 to 29-3-81.

#### **Institute library**

Two hundred and sixty four new titles were added during the year to make the total stock of books 14,307 on 31-3-81. Subscription to 28 journals continued during the year.

## Instructional Farm, Veterinary Hospital and Dairy & Poultry units

### *Instructional Farm*

The total area of the farm is approximately 40 ha, of which 27 ha were under cultivation. The farm provided facilities for practical classes of the students. The following seeds, seedlings and other planting materials were distributed during the year.

Vegetable seeds	137.57 kg
Paddy seeds	4775.00 kg
Gingelly seeds	28.50 kg
Coconut seedlings	725.00 kg
Banana suckers	347 Nos
Nutmeg seeds	10 ..
Pepper cuttings	175 ..
Tapioca stems	3000 ..

### *Veterinary Hospital*

The Unit started functioning from February 1977. The Junior Asst. Professor (Animal Husbandry) and one Livestock Assistant Grade-II attended to the hospital duties, in addition to the classes and their duties in the Poultry and Dairy units.

Total number of 1944 casses brought by the public were treated In the hospital during the period as detailed below:

Cattle	1226
Goats	391
Dogs	28
Birds	299
	<hr/>
	1944
	<hr/>

### *Dairy and Poultry Units*

The stock as on 31-3-81 was as follows:

Cow	15
Poultry	36

15928.35 L of milk and 5307 eggs were produced during 1980-81. The per day yield of milk was 40.53 L. Egg production per day was 15 to 20. ●

## CHAPTER III

# Research

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In the fields of Agriculture, Veterinary & Animal Sciences and Fisheries, research projects were implemented in 23 Research Stations spread out in the State and in the constituent Colleges (College of Agriculture, College of Horticulture, College of Veterinary & Animal Sciences and College of Fisheries).

Dr. P. C. Sivaraman Nair was appointed Director of Research on 9-3-1981. Till then, Prof. P. N. Pisharody Project Co-ordinator (Rice) held additional charge of the post. During 1980-81, the Scheme for strengthening the Directorate of Research was sanctioned under the National Agricultural Research Project with an outlay of Rs. 10.83 lakhs for five years from 1-6-1980. Under the scheme, Prof. P. N. Pisharody, Dr. N. Mohanakumaran and Dr. C. C. Abraham were appointed Associate Directors of Research for Adaptive Research & Training, Planning and Monitoring, respectively. Dr. R. Kalyanasundaram was appointed Associate Director of Research for Veterinary & Animal Sciences. Dr. M. M. Koshy and Dr. A. Venugopalan continued as the Professors (Research Co-ordination) for Agriculture and Veterinary & Animal Sciences, respectively.

There were three full time posts of project Co-ordinators. Prof. P. N. Pisharody was in charge of rice, Dr. K. P. Rajaram of Soils & Agronomy and Dr. Ananthasubramaniam of Cattle & buffaloes. The Research activities in the University are monitored and evaluated by the Project Co-ordination groups, the Faculty Research Committee and ultimately by the Research Council and the General Council.

There were 15 co-ordination groups in the Faculty of Agriculture and seven in the Faculty of Veterinary and Animal Sciences. Information on the groups, coordinators and membership is given in Appendix VI. Coordination groups had not been formed in the Faculty of Fisheries.

The F. R. C. (Agriculture) had its 13th, 14th, 15th and 16th meeting during the year. Two hundred and sixty four research projects were processed of which the FRC approved 227. The FRC (Veterinary & Animal Sciences) had its 9th meeting during the year. Forty four of the

fifty one projects processed were approved (Appendix VII). The FRC for Fisheries Faculty was constituted during the year,

The Research Council was reconstituted on 1.1.1981 (Appendix II) by co-opting more members from the three Faculties, bodies like the Executive Committee and some progressive farmers of the State to make the discussions effective.

A summary of the administrative aspects of the Research Stations/Projects/Schemes of the University follows. The details of Scientific and supporting staff are given in Appendix V. Publications made by the Scientists are listed in Appendix V.

## **AGRICULTURAL RESEARCH STATIONS/SCHEMES/PROJECTS**

### **The Rice Research Station, Pattambi**

Established in 1927, this is a major station for rice research in the University. Intensive work on varietal improvement, production technology and rice-based farming systems are taken up in the Station by a multi-disciplinary team of Scientists.

Sri. K. I. James, Associate Professor continued to be the Head of the station. Sixty one research projects (37 on rice, one on coconut, three on spices, 17 on pulses & oil seeds, two on post-harvest technology and one on Soils & Agronomy) were in progress. Of the 61 projects, 32 were under different ICAR schemes. Ten projects were concluded during the year. During the year, 15 new projects were sanctioned for implementation. A coordinated Scheme "for research on the Chemistry of submerged soils in the high rainfall areas" was implemented during the year. A project on recycling of paddy chaff was sanctioned for implementation.

The Seed Technology Laboratory attached to the station analysed 1329 seed samples. The Dairy unit with 15 milch cows and the Deep Litter poultry unit of 100 birds were maintained under the scheme on rice based mixed farming. The tank existing in the station was utilized for multiplication of fresh water fishes. A medicinal plant plot was also maintained.

The activities of the Krishi Vigyan Kendra attached to the Station continued during the year.

The Regional Monitoring Team consisting of the rice breeders of AICRIP, Andhra Pradesh, Tamil Nadu, Pondicherry and Kerala visited the Station in October. Mr. & Mrs. Anitha Anderson, representatives of the Swedish YMCA visited the KVK during August 1980.

### **The Rice Research Station, Moncompu**

The Station was established in 1940 with the objective of evolving rice varieties suitable for Kuttanad region. From 1963 onwards, the station

took up studies on soil and fertilizer management, crop protection, etc. in addition to varietal improvement.

Sri. N. Rajappan Nair, Associate Professor, continued to be in charge of the Station. There were 49 research projects in operation at the Station, of which 40 were on rice, one each on coconut and pulses, three on plant protection and the remaining two in fisheries. Fifteen of these projects were funded by the ICAR. Fourteen projects were concluded during the year. Seven new projects were approved for implementation during 1980-81. Two schemes—one on the study of the possible changes in the eco-system in Kuttanad and other on the development of BPH and GSV resistant paddy varieties continued to function during the year.

The Operational Research Project on integrated control of rice pests in Kuttanad fully financed by the ICAR was jointly operated by the Department of Agriculture and the KAU. The main objectives of the project are the introduction and practice of integrated control of rice pests with special reference to BPH, evaluation of the efficacy of integrated method over insecticidal control, determination and observance of economic thresholds for the important pests so as to minimise insecticide application and evaluation of the effect on socio-economic conditions of the rice cultivators. The activities were concentrated in two operational villages Pulincunnoo (paddy area-2871 ha) and Kizhakkumbhagom (paddy area-1100ha) representing the lower and upper Kuttanad, respectively. Champakkulam and Kozhimukku served as shadow villages in the respective regions. A review team consisting of Dr. S. Y. Padmanabhan, Dr. K. N. Mehrotra, Dr. Pahadia and Dr. S. K. Sarma visited the project area in February, 1981. Dr. V. T. John, Sr. Pathologist, AICRIP visited the Station during the year.

#### **The Rice Research Station, Kayamkulam**

The main objectives of the Station are the evolution of high yielding rice, sesamum and pulse varieties suited to the sandy tract, and the standardisation of cultural practices for these with reference to the Onattukara tract.

Sri. A. E. Sreedhara Kurup, Associate Professor was in charge of the Station upto 28-2-1981. On his retirement, Sri. M. G. Vasavan, Assistant Professor acted as head of the Station during March 1981.

Twenty nine research Projects—13 on rice, two on coconut, 14 on pulses and oil seeds were in operation, out of which 9 experiments were concluded during the year. The Extension Education Centre for pulses and oil seeds established in this Station during 1979-80 for imparting training to Departmental Officers and farmers continued to operate during the period under report.

### *The Rice Research Station, Vyttila*

The Station was established with the objective of evolving rice varieties suitable for the coastal acid saline marshes which are flooded by tidal waves and to formulate the cultural operations for raising rice and rice-cum-prawn/fish farming.

Sri. P. J. Tomy, Associate Professor continued to be in charge of the Station during the year. Twentynine research projects were under taken in the Station-14 on rice, one on coconut and seven under fisheries. Four of these projects were funded by the ICAR. During 1980-81, five research projects were concluded. Four new projects were sanctioned for implementation during the year.

Dr. S. Sivalingam from Kenya, Dr. H. K. Pande, Director, CRRRI, Cuttack and Dr. K. S. Murthy, Head of the Department of Plant Physiology, CRRRI, Cuttack visited the Station during 1980-81.

### *The Model Agronomic Research Station, Karamana*

The Station is mainly engaged in conducting the experiments of the All India Coordinated Agronomic Research Project (AICARP). Projects on soil and fertilizer management and other agronomic practices are also undertaken by the Station. Foundation seeds of improved rice varieties are produced and distributed.

Sri. K. Sivasankara Pillai, Associate Professor was in charge of the Station during 1980-81. There were 23 projects on rice operated in the Station, including two projects approved for implementation during the year. Of these, 15 were financed by the ICAR. One project was concluded during the year.

M/s. Y. Elkana, (World Bank Expert from Israel) Elk Kliuzen Schmith and Phanues Marx, (Scientists, Justusliebig University, West Germany) visited the station. Besides the ICAR Review team for AICARP headed by Dr. Shekon also paid a visit to the Station.

### *The Agronomic Research Station, Chalakudy*

The Agronomic Research Station was established in two hectares of leased land in the village of Periyaram during 1962, to take up studies on water management and cropping pattern in the command areas under the auspice of the State Department of Agriculture. The station was taken over by the University in 1973. The office and Laboratories of the station were shifted to the new buildings on 4-6-1980. The ICAR Co-ordinated Project for Research on Water Management started functioning in the Station from 1974. In addition, agronomic studies with relevance to irrigated areas are also implemented at the Station.

Dr. G. R. Pillai joined as the Professor of Agronomy and Head of the Station on 20-11-1980. Eighteen research projects were under Implementation, seven in rice, four in vegetables & tubers, four in

pulses and one each in Soils & Agronomy and fruits. Of these, two projects were concluded during the year. Seven were new projects sanctioned for implementation. Eleven of the 18 projects were funded by the ICAR.

Visitors to the Station included Dr. R. K. Rajput, Project Coordinator AICP for Research on Water Management and the NARP appraisal team headed by Dr. G. V. Ramanamurthy, Retd. Agricultural Commissioner, Government of India.

#### **The Research Station & Instructional Farm, Mannuthy**

The Station functioned as a part of the College of Horticulture to serve as an instructional unit for the students. Dr. V. K. Sasidhar, Assoc. Professor continued to be the Head of Office. Thirtyfour research projects (21 on rice, two on spices, three on vegetables, seven on pulses and one on Farming Systems) were implemented by the Station, of which two were concluded during the year. Fourteen research projects were funded by the ICAR. The visitors to the Station included the NARP appraisal team headed by Dr. G. V. Ramanamurthy.

#### **The Regional Research Station, Pilicode**

The Coconut Research Station, Pilicode/Nileswar was raised to the status of a Regional Station under the National Agricultural Research Project (NARP). The Station was established in 1916 to take up studies on cultural, manurial and other agronomic aspects of coconut cultivation. Introduction and study of the exotic and indigenous coconut cultivars, evolution of high yielding coconut hybrids, evolution of multiple cropping systems in coconut gardens. etc were the other objectives. Under the NARP, this has been reorganised as the Regional Research Station for the Northern Region comprising of the districts of Cannanore, Kozhikode and Malappuram, w.e.f. 1-6-1980. Intensification of research in respect of food grains, farming systems involving crop-livestock-fish production systems agronomic practices, soil & water conservation techniques as well as land use pattern for more efficient use of natural resources and ecological potential are the other objectives under the NARP. The Station has been provided with additional facilities (equipments, buildings, staff). Dr.P.K. Narayanan Nambiar, Associate Professor was the Head of office till 7-8-1980. Sri. K. Kannan, Professor of Horticulture took over as the Head of Office on 8-8-1980. Sri. K. Kannan was appointed Associate Director of Research (Northern Region) on 20-3-81. Twenty six projects were under implementation-19 on coconuts, three on Farming Systems and one each in spices, tubers, plant protection and Soils & Agronomy. Four projects were sanctioned for implementation during the year. Seven projects under the All India Co-ordinated Coconut & Arecanut Improvement Project were funded by the ICAR.

Consequent on the implementation of the NARP, action was initiated to acquire an area of 40 ha at Pilicode in addition to the

27.65 ha and 17.20 ha of land available at Pilicode and Nileswar. About 12 ha of land have been taken advance possession of during 1980-81.

#### **Coconut Research Station, Kumarakom**

The station established in 1947 by the Indian Central Coconut Committee was taken over by the State Government in 1958. From 1972 onwards, the station is under the Kerala Agricultural University.

The main objective of the station is to conduct research on coconut and coconut based cropping patterns. Twenty two research projects—19 on coconut and three on fisheries were under implementation. A project on mixed farming of coconut, livestock and fish culture and an ICAR project on "propagation and farming of frogs" were in progress. The KAU initiated during 1980-81 research work aimed at the control of the root (wilt) disease of coconut palms.

Sri. B. Thomas, Associate Professor was in charge of the Station till 8-2-1981. Sri. U. Mohamedkunju, Professor of Agronomy took over on 9-2-1981. An area of 21.68 ha adjacent to the Station, occupied by the State Seed Farm was transferred to the University on 2-7-1980.

A "farmer's training programme and field day" was conducted by the Station during March, 1981. Visitors to the station included Dr. Rerose (ICI Plant Protection Division, Fernhurst, U.K.), Dr. N.M.Nayar & Dr. N. P. Jayasankar of CPCRI, Prof. A. Volker & Dr. Van Aart (Danish Scientists) and Dr. P. N. C. Pillai, Agricultural Expert, Government of Kerala.

#### **The Coconut Research Station, Balaramapuram**

Varietal, manurial and cultural trials on coconut are conducted at the station to arrive at suitable recommendations for cultivation of coconut in the red loamy soils. Sri. E. P. Koshy, Associate Professor continued to be in charge of the station. There were nine research projects on coconut being implemented in the station. One was sanctioned in 1980-81. The station conducted a one-day agricultural seminar and farmers training during March 1981 in connection with the lab-to-land programme.

Visitors to the station included Dr. R. Shepherd (Director of Research, Harrisons & Crossfield, Malaysia), Sri. Harbans Singh (Chief Agricultural Expert, Govt. of India) Sri. Paul F. Tax of World Bank and a team of officers of the University of Agri. Sciences, Bangalore.

#### **The Cardamom Research Station, Pampadumpara**

The station is one of the co-ordinating centres for research on cardamom under the All India Co-ordinated Spices & Cashew Improvement Project.

Dr. L. Rema Devi, Assoc. Professor was in charge of the Station till Sri. D. Joseph, Associate Professor took over during March, 1981.



Twenty research projects on cardamom and one on pepper were under implementation. Of these, two were sanctioned only during 1980-81.

An additional five ha of land were brought under cardamom during the year, making the total area under cardamom to 40ha. A field day-cum-seminar and exhibition was arranged during Feb. 81 in which 325 farmers from different parts of Idukki district participated.

#### **Horticultural Research Station, Ambalavayal**

The station was established in 1946 as a part of Wynad colonisation scheme to carry out research aimed at agricultural development of the region, to make available quality seeds, plants, etc and to render scientific advice to the farmers of Wynad area. This is one of the important stations under the University where intensive work on fruits, spices, and essential oils are undertaken.

Sri. M. K. Mammen, Assoc. Professor continued to be in charge of the station. Twenty five research projects were under implementation which included 14 on citrus and three on spices. Two projects were concluded during the year. The citrus projects were funded by the ICAR under the All India Co-ordinated Fruit Improvement Project (AICFIP).

A two-day seminar & exhibition was organised in January 1981 under the lab-to-land programme. Sri. M. K. Mammen and Sri. G. Indrasenan attended the National Seminar on tropical and sub-tropical fruit crops held at Hebbal in January 1981. Visitors to the station included Dr. H. C. Dass, Project Co-ordinator, AICFIP.

#### **The Lemongrass Research Station, Odakkali**

The main objective of the station is to investigate upon the agronomic, botanical, post-harvest and bio-chemical aspects of various essential oil yielding crops.

Sri. E. V. G. Nair, Associate Professor continued to be in charge of the station. Twelve research projects in essential oil yielding crops were under implementation, of which four were concluded during the year. Two projects were sanctioned during the year.

One training camp and a field day were organised during the year under lab-to-land programme. Under the village adoption programme, five ward-wise training camps were organised.

#### **The Pepper Research Station, Panniyur**

The Station was started in 1952-53 to evolve high yielding varieties of pepper and to standardise cultural, manurial and plant protection measures for pepper. During the year under report, an additional 12 ha of land was acquired making the total extent 26.5 ha. The station has been classified as a sub-station under the NARP Northern Region and has been allotted the lead function for research on pepper.

Sri. V. Sukumara Pillai, Associate Professor continued as the Head of the Station. Sixteen projects on pepper were implemented. Two projects were concluded during the year. Seven experiments were in progress under the All India Co-ordinated Spices and Cashew Improvement Project.

A Meteorology observatory (B Class) was established during the year under report. A field day and training programme was conducted in March 1981. Sri. V. Sukumara Pillai attended the International Symposium on 'Processing of pepper', held at Mysore. Sri K. P. Mammooty attended the workshop on "Diseases and manuring of Plantation Crops" at Madurai.

### **The Banana and Pineapple Research Station, Kannara**

The Banana and Pineapple Research Station was started at Kannara in 1963. The venue of pineapple research was shifted to Vellanikkara in 1974. The main objectives are to evolve superior varieties of banana and pineapple and to standardise the cultural, manurial and plant protection aspects.

Sri. P. C. Jose, Associate Professor continued as Head of Station till 20-2-1981, after which Dr. M. N. C. Nair was in charge. Fifty one reasearch projects were under implementation-49 in banana & pineapple and two in Farming Systems. Twenty eight of these were under the All India Co-ordinated Fruit Improvement Project funded by the ICAR. Twenty three projects were concluded during the year. Two new schemes were sanctioned for implementation during 1980-81.

### **The Cashew Research Station, Anakkayam**

The station was established in 1963 to evolve materials, methods and means to increase the production of cashew.

Sri. M. Oommen, Associate professor was the Head of the Station till he entered on study leave on 3. 1. 1981. Sri. V. K. Raju, Jr. Asst. Professor held charge of the post from 3.1.1981. Ten research projects on cashew were under implementation. Two projects were concluded during the year.

Under the lab-to-land programme, 18 farm families were adopted. Two farmers day and training programmes were conducted during the year, which were attended by more than 200 farmers. One thousand cashew layers were supplied to the Seed Garden Complex at Nilambur (SADU). Visitors to the station included Sri. V. K. Balakrishna Menon, I.A.S., District Collector, Malappuram, Sri. Kailasam, Programme Officer, Lab-to-land programme and Sri. G S. Mukubuta, Department of Agriculture, Mongu, Zambia.

### **The Sugarcane Research Station, Thiruvalla**

The station was established in 1975-76 to intensify research on various aspects of sugarcane cultivation. The station is a co-ordinating centre under the All India Co-ordinated Sugarcane Improvement Project.

Sri. P. K. Chellappan Nair, Associate Professor continued as Head of Office during the year. Sri. S. G. Sreekumar was awarded ICAR senior fellowish and was granted leave for study purpose for under-going Ph. D. programme. Sri. S. Sukumaran Nair, Associate Professor & Special Officer attended a ten-day training at the Jute Agricultural Research Institute in Aug-Sept 1980. He also attended the working group meeting on jute cultivation in peninsular India held at Bombay in April 1980. Eighteen research projects (of which six were funded by the ICAR) were in progress. One project was sanctioned for implementation during the year.

The station conducted training programmes for the field staff of the Mannam Sugar Mills and for the Officers of the Department of Agriculture on the scientific methods of sugarcane cultivation.

The Vice-Chancellor and members of the Executive Committee visited the station during October, 1980.

### **All India Co-ordinated Spices and Cashew Improvement Project Sub-Centre, Madakkathara/Anakkayam ✓**

The Sub-centre was started in 1972 at Anakkayam and was shifted to Madakkathara in 1973 for want of sufficient area at Anakkayam for the lay out of the experiments. The main objectives are to identify/evolve high yielding types, to standardize cultural aspects including propagation, and to evolve control measures for the important diseases/pests. Dr. P. K. Vijayan, Associate Professor was the Head fo the Station till 30-9-1980 when he retired from the University service. Dr. M. N. C. Nair, Associate Professor held additional charge from 1.10.80 onwards.

There were eight research projects in cashew under implementation.

### **Pepper Research Scheme, Vellanikkara**

The scheme envisages studies on pepper with special reference to cultural, manurial and varietal trials. Collection, maintenance and evaluation of germplasm is also envisaged.

Dr. Abi Cheeran, Professor was in charge of the scheme. Six research projects on pepper were in progress. In addition, a Central nursery for hybrid pepper also functioned.

Training of the Agricultural Demonstrators under the 'T & V' programme, examination of diseased specimens brought by the farmers, distribution of rooted cuttings of Panniyur-1 etc. were also attended to by the scientists working in the scheme.

### **Scheme for intensification of sugarcane research in Kerala**

The scheme was sanctioned for implementation from 1978-79 onwards with the objective of studying the botanical and cultural aspects of sugarcane and to screen out varieties suitable for Kerala.

Dr. K. M. Narayanan Namboodiri, Professor, was in charge of the scheme. Sri. K. Chandrasekharan Nair, Assistant Professor was in charge of the centre at Menonpara, Chittoor. Experiments were laid out in Chittoor, Thiruvalla, Idukki and Punalur.

### **All India Co-ordinated Floriculture Improvement Project, Vellanikkara**

The scheme started functioning from 1978-79 with the objective of testing the performance of rose cultivars and the genetic improvement of hibiscus, marigold, tuberose etc.

Sri. K. M. George, Associate Professor was in charge of the scheme. Out of the 14 research projects envisaged, seven were under implementation during the year.

### **ICAR ad-hoc scheme on survey, collection and evaluation of germplasm of jack, Vellanikkara**

The scheme was sanctioned for three years from 1.7.1978 to conduct a detailed survey, collection and evaluation of germplasm of jack. Dr. K. Kumaran, Associate Professor continued to be in charge of the Scheme. Dr. Kumaran attended the PLACROSYM-III. During the year, 112 types were collected, evaluated and nine were selected.

### **Kerala Agricultural Development Project**

The sub project for research and training under the Kerala Agricultural Development Project continued to function during the year. The project envisages intensive research on coconut, cashew, pepper and cocoa.

Dr. P. C. Sivaraman Nair continued to be the Co-ordinating Officer. All the 49 research projects approved have been initiated and were under various stages of implementation. Construction of the Radiotracer Laboratory progressed well during the year. One batch of Jr. Agricultural Officers and one batch of Agrl. Demonstrators were given intensive training during the year.

### **All India Co-ordinated Agronomic Research Project**

Sponsored by the ICAR, the scheme aims at studying the comparative performance of pre-release material and popular varieties of rice with reference to their fertilizer requirement under irrigated and assured water supply conditions. The project functioned at the Model Agronomic Research Station (Karamana), Kottayam unit and Kozhikode unit.

The Headquarters unit functioned at the Rice Research Station, Pattambi till 9-6 1980 when it was shifted to Vellanikkara. Sri. V.

Ramachandran Nair, Associate Professor was in charge of the Headquarters unit till 26-12-80. and Sri. I. P. Sreedharan Nambiar, Associate Professor from 26-12-80. The Kottayam unit functioned at the Rice Research Station, Moncompu. Sri. K. Sankara Panicker, Assistant Professor was incharge of the unit.

The Kozhikode unit conducted 188 experiments in cultivators fields. Sri. S. Janardhanan Pillai, Assistant Professor was incharge of the unit till 21-12-80, after which Sri. Abraham Varghese tookover.

#### **Centre for conducting research on pulses and oil seeds in the command areas**

The scheme was started in 1979 and covers the command areas of Malampuzha, Peechi and Chalakkudy. The scheme aims at (i) location specific research and training in the production of suitable pulses and oil seeds, (ii) introduction of them to the irrigated farming systems, (iii) developing technology for growing pulses and oilseeds in areas not benefitted by irrigation canals.

Sri. T. F. Kuriakose, Associate Professor was incharge of the scheme till 27-11-1980 when Sri. U. Mohammedkundu was appointed Professor of Agronomy in the scheme. Dr. V. K. Sasidhar, Professor of Agronomy was in charge from 1-2-81 to 16-3-81 after which Dr. E. Tajuddin, Professor of Agronomy took over.

Trial plots in cowpea, greengram, sesamum and groundnut were laid out during the year.

#### **All India Coordinated Project for Research on Forage Crops, Vellayani**

The Vellayani centre of the AICP for research on forage crops was started in 1971 with the object of conducting intensive research on agronomic aspects of promising forage crops.

Sri. G. Raghavan Pillai, Associate Professor was in charge of the centre. Sri. Pillai attended the annual workshop on forage crops held at the Rajendra Agricultural University, Bihar, During the year under report, 15 major field experiments were laid out.

#### **All India Coordinated Research Project on Biological control of crop pests, Vellanikkara**

The project aims at working out biological control measures for the weeds *Salvinia molesta*, *Eupatorium odoratum* and the brown plant hopper (*Nilaparvata lugens*).

Dr. C. C. Abraham, Professor of Entomology was incharge of the project till 17-3-81. Dr. P. J. Joy, Associate Professor took the charge on 17-3-1981.

## VETERINARY & ANIMAL SCIENCES-RESEARCH STATIONS/ FARMS/SCHEMES/PROJECTS

### University Livestock Farm, Mannuthy

The farm functioned as teaching, research and extension unit. The farm maintained cross bred dairy cattle of the breeds Jersey, Brown swiss and Holstein. The herd strength on 1-4-80 was 313 and at the end of the year 169. Total milk production during the year was 2,20,526kg. The milk yield per day was 623.5kg. The average yield per milking animal per day was 5.4kg.

### Livestock Research Station, Thiruvazhamkunnu

Situated in the Mannarghat taluk of Palghat district, the station undertakes projects on breeding buffaloes and cattle. Dr. C. S. James continued to be in charge of the station during the year.

The farm has a total area of 163.3 ha of which nearly 32 ha are uncleared forests. An area of 78.37 ha is used for fodder cultivation and 42.93ha as grazing land for animals.

The livestock strength of the station as on 1-3-80 is as follows:

Milking animals	80 nos.
Dry animals	56 "
Breeding bulls	4 "
Work cattle	4 "
Young stock	59 "
Total	<u>203 nos</u>

The average milk production during the period was 4.7kg/ animal/ day and the total quantity of milk produced during the year was 1,55,022.7kg, a major quantity of which was sold to Milma.

A poultry unit consisting of 50 layers were started during the period as a part of the expansion programme of the station. Four tribal goat sheds were constructed by employing Adivasis from Attapadi, for utilizing it for the proposed goat unit.

A cow barn capable of accomodating 40 animals was commissioned during the period. Irrigation facilities were extended to cover 4 ha of land. During the year, 2330.5 T of green fodder, 389 T of silage and 110.1 T of hay were produced in the farm.

There were two research projects in operation in the station and two research projects were approved during the year for implementation in the farm.

### Cattle Breeding Farm, Thumburmuzhi

The farm is mainly functioning as an ancillary farm for rearing calves to a stage of seven months pregnancy and subsequently distributing them to other Dairy farms under the University. The station at present has

also taken up research on cross bred calves. Dr. K. Parameswaran Nair, Associate Professor continued as the Head of the farm.

There were 228 cattle belonging to different age groups maintained in the farm. Forty seven calves and 47 animals in advanced pregnancy were transferred to other farms of the University during the year. A quantity of 1224T of fodder was produced in the farm during the period. Two research projects were in operation.

#### **University Poultry and Duck farm, Mannuthy**

The primary objective of the farm is to impart training to the students of the college of Veterinary and Animal Sciences.

Dr. G. Raghunathan Nair, Assistant Professor continued to be incharge of the farm.

There were 5262 numbers of poultry at the beginning of the year and 7905 at the end, During the year, 23,290 birds and 2,01,804 eggs were sold realizing an amount of Rs. 2,37,279.

#### **University Pig Breeding farm, Mannuthy**

The farm functioned as a training unit for the students of the College of Veterinary and Animal Sciences, besides serving as a breeding centre for producing good quality piglets for distribution among farmers.

Dr. P. C. Saseendran, Assistant Professor, continued to be incharge of the farm.

The animal strength at the end of the year was 362. During the year, a total number of 384 piglets were distributed from the farm.

Two research projects were in operation in the farm.

#### **University veterinary hospital, Kokkalai, Trichur**

Apart from providing instructional facilities and practical training to the students of the Veterinary College, the Hospital served as an institute for providing all kinds of veterinary aid to animals in and around Trichur. Dr. K. Ramadas, Associate Professor continued as the head of the Hospital.

Forty six students of B. V. Sc. classes were given practical training in various aspects of clinical diagnosis and treatment of animal diseases. Besides, two postgraduate students did their advanced training during the year.

A total number of 30,524 animals were given veterinary aid during the period. Besides, 14,373 birds were provided with protective vaccinations. The daily average attendance was 83.3 at the hospital.

#### **AICRP for investigation on Agri. Bye products and Industrial waste materials for evolving economic ration for livestock**

The project envisages to evaluate the agricultural waste, forest products and bye products of agriculture based industries as possible source of cattle feed and to evolve non-cereal economic rations for feeding of cattle, buffaloes, goats and pigs.

Dr. C. R. Ananthasubramaniam was in charge of the scheme from 1-4-80 to 17-4-80 and from 31-1-81 to 31-3-81. Dr. C. T. Thomas held the charge during the period from 17-4-80 to 31-1-81.

Forty bye products were evaluated for their suitability as livestock feed and seventeen items were found suitable for inclusion in the cattle rations and three items in poultry rations. Some of the bye products standardised for feeding purposes under this project have been accredited with I. S. I. specifications eg. Rubber seed cake, I. S. 9599-1980 and Tapioca spent pulp, I. S. 5064-1980.

Dr. C. R. Ananthasubramaniam was awarded special Merit certificate by the Compounded Livestock Feed Manufacturers Association of India 1980 (C. L. F. M. A). Dr. A. D. Mercy obtained the following Gold medals and prizes during the year:

Dr. K. S. Nair Gold Medal  
Sri. M. C. Thomakutty Gold Medal  
Inauguration Souvenir Gold Medal  
Sri. T. V. Kochuwareed Gold Medal  
VIII Dairy Industry Conference Gold Medal  
The Gossi Dairy prize  
Peoples Dairy prize  
C. L. Vareed Memorial prize  
Dr. V. N. Krishna Iyer prize

Besides the two ongoing research Projects, four new projects were sanctioned during the year. One research project was concluded during the period under report.

#### **A, I. C. R. P. on Poultry for eggs**

The scheme funded by the ICAR started functioning from Feb. 1977. Three strains, IWN, IWP and IWO procured from the Hyderabad Centre of the Project and the F strain from the Kerala Agricultural University Poultry Farm, were maintained in this Centre. The  $S_2$  generation birds of IWN & IWP and  $S_0$  generation of IWF and IWO strains were under test during the year under report.

During the year 1980-81, the  $S_1$  generation pullets of IWN and IWP strains completed 280 days of age. Breeding pens were set up with selected dams and sires in each strain and pedigree hatching was initiated to produce the  $S_2$  generation. The average values of internal egg quality characters for the  $S_1$  generation of IWN and IWP strains were measured on 200 eggs of each strain at 38-40 weeks of age.

Random birds of  $S_1$  generation of IWN and IWP strains maintained for recording egg production upto 500 days of age completed the testing period during the year.

Hatching operations to produce  $S_2$  generation progeny from the  $S_1$  generation birds continued and a total of seven hatches from either



strain were procured. The  $S_2$  generation pullets of both the strains were housed at 16 weeks of age and their body weights were recorded at 20 weeks of age.

During the first and second quarters of the year under report, attempts to produce the  $S_1$  generation progeny of 'F' strain, that had suffered a severe set back due to the problem of aflatoxicosis continued. However, the hatchability situation did not improve and enough progeny could not be procured during the ensuing quarter, probably due to irrecoverable damage caused to the flock owing to the intake of the toxin. Therefore, during the third quarter of the year, the existing  $S_0$  and  $S_1$  generation flocks were liquidated. During the fourth quarter, fresh  $S_0$  generation chicks were raised from the eggs of the same strain obtained from the University Poultry Farm.

Besides, during the 3rd quarter, two hatches of strain crosses involving  $S_1$  generation parents of IWN and IWP strains were obtained

During the third quarter of the year, 830 female and 320 male chicks of IWO strain were purchased from the Hyderabad centre to form the  $S_0$  generation flock of IWO strain in the project.

#### **A. I. C. R. P. on goats, Mannuthy**

The project envisages the evaluation of cross bred goats for suitability in raising under the agroclimatic conditions of Kerala, with good milk yield potential.

Dr. B. R. Krishnan Nair, Associate Professor continued to be in charge of the project.

Fifteen research projects were in operation during the year. The livestock strength as on 31-3-81 was 118 male and 475 females. A total quantity of 6983.65 kg of milk was sold during the year. The per day milk yield was 73.15 kg, with a per day lactation average of 0.74 kg.

### **FISHERIES RESEARCH STATIONS/SCHEMES/PROJECTS**

#### **Fisheries Unit-Rice Research Station, Vyttila**

In the Rice Research Station, Vyttila, a Fisheries Unit has been established, since 1976, for taking up studies on the culture of brackish-water fishes and prawns. A sub-centre of the All India Co-ordinated Research Project on Brackishwater Fish Farming has been functioning here from 1976 onwards under the control of an Associate Professor (Fisheries). Besides, this unit has been taking up studies on the possibilities of fish culture in pokkali fields along with paddy, and fish & prawn culture after the harvest of paddy. Seven different projects on fisheries were undertaken during the period.

### **Fisheries Unit-Coconut Research Station, Kumarakom**

The Fisheries Unit at the Coconut Research Station, Kumarakom was started as a part of programme for studying the possibility of integrating fish culture along with crop farming and cattle rearing. Studies are undertaken to find out the suitable species of fishes which can be cultured in the channels available in coconut groves available extensively in reclaimed areas of Kerala. An ICAR adhoc scheme on "Farming and Propagation of frogs" was started during February 1979. Altogether, three projects on fisheries were implemented.

### **Fisheries Unit-Rice Research Station, Moncompu**

The Fisheries Unit at Moncompu mainly concentrated on studies connected with the culture of fishes and the giant freshwater prawn *Macrobrachium rosenbergii* along with paddy and also after the harvest of paddy in the Kuttanad area. Studies on these and also to evolve a cropping pattern incorporating fishes and prawns for the kayal fields were carried out. Two projects were implemented here during the period.

### **Instructional Farm for Fisheries, Puduveypu**

An area of 101 ha have been transferred by the State Govt. at Puduveypu during July 1979. The Station was under the charge of a Junior Assistant Professor.

The instructional Farm at Puduveypu was started mainly for the practical training of the students in brackishwater fish farming. Research is also being taken up in brackishwater fish farming and mariculture. Collection and distribution of brackishwater fish and prawn seed are also being undertaken.

## **AGRICULTURE**

### **RICE**

#### **CONCLUDED PROJECTS**

##### **Crop improvement**

*Initial evaluation trial of hybrid cultures of rice and district trial with Cul. 31-1 of cross Kottarakkara-1 X Poduvi (Kayamkulam)*

Comparative yield trial of three cultures of the cross Kottarakkara-1 x Poduvi (Cul. 24-8, Cul. 31-1 and Cul. 36-5) was conducted for three years from 1978. Maximum yield of 3825 kg/ha was recorded by Cul 31-1.

District trial with the Cul. 31-1, was conducted at the State Seed Farm, Kadakkal, Kottarakkara and in cultivators' fields at Thalachira

during 1979-80. Minikit trials were conducted at eight different locations during 1980. Culture 31-1 recorded significantly superior yield. Maximum yield upto 6722 kg/ha was recorded by this culture. The fertilizer response of this variety was studied and NPK application at 50:35:35 kg/ha was recommended. Cul. 31-1 was released during the year as 'Kayamkulam-1' (Lakshmi). The variety is photosensitive with a duration of 165-180 days. It is non-lodging and is moderately resistant to sheath blight and fairly resistant to stem borer.

*Evaluation of selected cultures from the cross IR-8 x Karivennel (Moncompu)*

Three cultures (M-23-7-1-1, M-23-33-3-1 and M-22-65-2-3-1) were selected for district trial. Trials were conducted during the additional crop and punja seasons of 1980-81. Both in the additional crop and punja seasons, Culture M-22-65-2-3-1 recorded the maximum yield.

*Trial with the Moncompu cultures (Karamana)*

The performance of Cul. 7-1-1, 33-3-1, 65-2-3-1, Jaya, Bharathi and I.R.8 was studied during kharif and rabi. During kharif, Bharathi gave the highest yield of 42 Q/ha followed by I R.8 (39 Q/ha) and Jaya (35.78 Q/ha.). Culture 65-2-3-1 yielded 37.87Q/ha while culture 7-1-1 yielded 36.33 Q/ha and Jaya 34.49 Q/ha during rabi season.

*Pureline selection in Cheruvirippu and district trial of Cheruvirippu cultures (Vyttila)*

On the basis of the results obtained in the comparative yield trials at the Station during the period from 1975 to 1979 and in the multilocational trials conducted in cultivators' fields in Ernakulam and Alleppey districts, proposals were submitted to the Variety Evaluation Committee to release the culture 174 as a new improved variety for cultivation in the pokkali areas. In the tenth meeting of the State Seed Sub Committee held on 11th August 1980, it was decided to release the culture 174 as Vyttila-2 for cultivation in saline areas in the pokkali regions of Ernakulam and Alleppey districts. The new variety (Vyttila-2) was released for general cultivation by the Home Minister of Kerala in a public meeting held on 21st March 1981 at the Rice Research Station, Vyttila.

*Final evaluation of BPH resistant cultures (Moncompu)*

Three cultures (1537-2, 1537-1 and 1544-2) were selected for district trials. The district trials were laid out in cultivators' fields at Nedumudy, Kumarakom, Thakazhy, Muttam and at the Rice Research Station, Moncompu during the punja season of 1980-81. Culture 1537-2 recorded the maximum yield in four locations. Pooled analysis of the data also indicated that culture 1537-2 was the best.

### *High protein rice varieties through induced mutation (Mannuthy)*

This experiment was started during 1975-76 with a view to evolving high protein rice through induced mutagenesis from Jyothi, employing gamma rays. Selections were made in M2 and later generations. The isolated lines were subjected to protein analysis. There was no statistical difference between the various selections and the control.

### *Effect of herbicides on cell division, sterility and yield in rice (Vellayani)*

The study indicated that herbicides induce chromosomal aberrations. The highest frequency of chromosomal abnormalities were observed with 2,4-D and Nitrofen treatments, when applied at a dose of 1 kg and 1.5 kg active ingredient per hectare, eighteen days after transplanting. Such abnormalities caused pollen sterility and consequent spikelet sterility leading to reduction in yield. A comparatively high yield was obtained in 2,4-D treatment which also showed the highest percentage of chromosomal aberrations and pollen sterility.

### *Dormancy behaviour of important high yielding paddy varieties cultivated in Kerala (Pattambi)*

The study was intended to determine the post harvest dormancy period during virippu and mundakan seasons for short, medium and long duration high yielding varieties of rice cultivated in Kerala. It was observed that the period of dormancy for the varieties were different. It ranged from 8 to 62 days for virippu and 2 to 40 days for mundakan. Longer duration varieties exhibited longer periods of dormancy with the exception of Mashoori. Among the varieties tested, Triveni showed the lowest and Jaganath, the highest dormancy during both the seasons.

### **Crop management**

#### *Crop sequence trial (Kayamkulam)*

To formulate a suitable cropping pattern for Onattukara rice fallows, a crop sequence trial was conducted, altering the various crops such as groundnut, cowpea, sweet potato, greengram, ragi, gingelly and blackgram from 1976 onwards.

The three-year trial indicated that in the rice fallows of Onattukara where sesamum cannot be advocated, catch crops like groundnut (TMV 2), blackgram (CO-2) or cowpea (New Era) can be grown during the third crop season (January-April) as rainfed crop, depending on the reserve moisture status of the soil.

#### *Effect of varying the level of nitrogen on the comparative growth of panicle and leaves in rice (Oryza sativa L.) (Vellayani)*

Nitrogen enhanced leaf area and dry weight of leaves. A linear increase in spikelet number was observed with increase in N levels.

Higher levels of N increased the number of partially filled grains, number of unfilled grains and reduced 1000 grain weight. All varieties showed low response to N, except Ptb-42. Positive correlations were observed between levels of N and leaf area, dry weight of filled grains and dry weight of fully filled grains, in Ptb-42.

*Studies on increasing nitrogen use efficiency in low land rice (AICRIP, Pattambi)*

The experiment was conducted during both first and second crop seasons. Among the different forms of nitrogen tried, granulated compost offered good scope during both the seasons.

*Technique for increasing nitrogen use efficiency of urea (Moncompu)*

The results of pooled analysis of data collected for three years indicated that grain production of paddy is considerably affected when the dose of nitrogen is reduced from the recommended dose of 90 kg/ha. The basal application of 90kg N/ha as urea in paper packets was found to be equally effective as its split application as per package of practices and was significantly superior to all other treatments, including mud ball placement and urea mixed with six fold moist surface soil.

*Multilocal trial on blue green algae (Vytila)*

The experiment was conducted for two years (1979-80 & 1981-81) in pokkali crop. The treatments with and without blue green algae under different levels of nitrogen included:

- Full dose of N, P & K
- 2/3 N + full P & K with BGA at 10 kg/ha
- 2/3 N + full P & K
- 1/3 N + full P & K

The results were erratic during 1979-80. The trial was repeated in 1980-81. Due to heavy rains and consequent flood for 35 days continuously, the crop was completely lost. But the following observations were recorded during the period:

Algae had luxuriant growth, forming mattings of algal colonies in the entire field. Under the flooded conditions, the algal colonies spreaded over the entire field (both treated and untreated plots) and thus vitiated the experiment. Algal mattings floating over the flood water swept away the fragile seedlings during winds and thus accelerated the damage. When water level subsided, the algal mattings smothered the seedlings on the mounds and thus contributed for a total loss of the crop.

The blue green algae seemed to be unsuitable for pokkali area where water level is always high. Alga is likely to create problems in broadcast crop of rice where water level cannot be controlled.

*Studies on the utility of azolla and blue green algae for partially substituting the N requirement of rice and to evaluate its utility in rice culture (AICRIP, Pattambi)*

This experiment was conducted during first and second crop seasons. Application of azolla or blue green algae did not show any consistent and significant effects. The trial was concluded after conducting it for six seasons. The pooled analysis did not show any significance.

*Nitrogen economy through incorporation of azolla in rice (Chalakudy)*

An experiment was conducted during the first and second crop seasons to study the effect of basal incorporation of azolla on growth and yield of rice and the extent of saving in nitrogen.

The study revealed that in both the seasons, application of 75% nitrogen along with the incorporation of azolla was enough to produce as much grain yield as obtained from 100% nitrogen, applied either alone or in combination with FYM or azolla. Azolla compared favourably with farm yard manure as a source of organic nitrogen. Incorporation of azolla could save 25% of the inorganic nitrogen required for rice. Straw yield increased with nitrogen levels, particularly in combination with azolla or farm yard manure.

*Effect of split application of  $P_2O_5$  on the growth and yield of rice (Moncompu)*

The trial was conducted during the additional crop season of 1980 and has been concluded as directed by the FRC. The data on growth and yield attributes of paddy were analysed. The available  $P_2O_5$  in the soil at the maximum tillering stage, panicle initiation stage and at harvest were estimated. None of the growth or yield characters was significantly influenced by any of the treatments. The available  $P_2O_5$  in the soil at the different growth stages did not show any variation.

*Trial with Phosmak for acid soils of Kuttanad (Moncompu)*

Three sources of phosphorus and three levels of  $P_2O_5$  were compared with a "noP" control. The results of pooled analysis of the data for five seasons indicated that application of Phosmak at different levels has no added advantage over the other phosphatic fertilizers, as evidenced by grain yield.

*Micronutrient trial on rice (Mannuthy)*

The object of the present study was to investigate on the role of copper and zinc in combination with N, P and K on the yield of rice. The experiment was conducted for six seasons and it was concluded that the micronutrients tried had no effect on the yield of grain and straw in paddy in Mannuthy soil.

*Studies on the premature drying of paddy leaves during punja season in Kuttanad (Moncompu)*

The results of the trial indicated that foliar application of 1% solution of micro-nutrients at the dough stage reduced the drying up of the leaves significantly. But the treatments were found to have no effect on grain and straw yield.

*Weed control trial for direct sown rice in Kuttanad (Moncompu)*

The trial was conducted for three years. Results of pooled analysis of the data revealed that spraying stam F 34 @ 1 kg ai/ha plus MCPA @ 0.5 kg ai/ha with 3% fresh urea had the best weed control efficiency among the herbicidal treatments.

*Influence of missing hills on the general vigour of surrounding hills in paddy crop (Moncompu)*

Results of the experiments conducted for three seasons indicated that when two plants were continuously missed in a row, the surrounding plants showed greater mean measurements in all yield contributory characters when compared to the case of missing three plants continuously in a row. The difference between mean measurements of plants influenced by missing one hill in a location and those of normal hills was not significant statistically.

**Plant protection**

*Role of soil amendments on the incidence of important rice diseases (Moncompu)*

The results of the trial indicated that the intensity of sheath blight was low in those treatment plots where manganese or rice husk was applied. Minimum sheath rot incidence was noted in plots treated with marotti cake and boron. Highest yield of grain and straw were recorded in plots treated with marotti cake and molybdenum.

*Chemical control of sheath blight disease of rice (Pattambi)*

This project was to evaluate a few promising fungicides in controlling sheath blight disease. MBC recorded the lowest disease score with highest grain yield.

*Screening for sheath blight resistance (Pattambi)*

It is an attempt to screen varieties, cultures and breeding materials for resistance to sheath blight disease under transplanted conditions. Out of the 280 entries in NSN-I and 285 entries in NSN-II, only seven in NSN-I and 15 in NSN-II showed moderately resistant reactions. In nine out of the 22 entries which reacted as moderately resistant either T 141 or Pankaj was one of the parents.

*Role of rice root nematode, Hirschmaniella oryzae, on the incidence of sheath blight of rice (Vellayani)*

Pot culture studies involving different levels of nematode inoculum and the sheath blight fungus, *Rhizoctonia solani* indicated that disease

severity was maximum at the highest nematode inoculum level. The soil and root population of the rice root nematode was found to be significantly higher in plants severely affected with sheath blight.

Field evaluation of fungicides, mineral nutrients and nematicides showed that combined application of Furadan 3 G and spraying Vitavax or Fycop could reduce the severity of sheath blight, increase grain yield and reduce the rice root nematode.

*Symptomatology, etiology and control of sheath rot of rice caused by Acrocyndrium oryzae Saw. (Vellayani)*

The pathogen was confirmed as *Acrocyndrium oryzae* Saw. by various morphological and physiological studies, and pathogenicity tests. The most susceptible part of the crop was found to be the flag leaf sheath of rice. Host range studies showed that six field weeds namely, *Echinochloa crusgalli*, *Eleusine indica*, *Monochoria vaginalis*, *Cyprus iria*, *C. difformis* and *C. tenneriffac* were collateral hosts of the pathogen.

The fungus could produce toxic metabolites. A comparative chemical analysis of infected and healthy leaf sheaths of the rice variety Triveni showed considerable reduction in both total sugars and phenolics in the infected sheaths. Preliminary studies on the relation of microclimatological factors with the disease showed that hot and humid conditions favoured the incidence of the disease. Under field conditions, Hinosan followed by Vitavax and Dithane were effective in controlling the disease.

*Etiology and control of bacterial leaf blight of rice caused by Xanthomonas oryzae (Uyeda and Ishyima) Dowson (Vellayani)*

The pathogen of the disease was identified and confirmed as *Xanthomonas oryzae* based on the morphological, cultural and physiological characters, and its pathogenicity. The pathogen was found to survive in infected seeds, plant debris and soil. Pot culture experiments using antibiotics on the control of the disease showed that post inoculation sprays offered better control of the disease than pre-inoculation sprays. Agrimycin 100 (250 ppm) was found to be effective in lowering the disease.

*Screening for leaf blast resistance (Pattambi)*

The project was to evaluate NSN entries for leaf blast reaction under nursery conditions. A total of 565 entries were tested under NSN I and II. The disease pressure was high with a mean LSI of 5.81

*Chemical control of blast disease of rice (Pattambi)*

Evaluation of promising fungicides in controlling blast disease of rice in endemic areas in plains was the objective of this study. Among the fungicides tested, MBC, Hinosan and Bavistin were effective in checking the leaf blast. MBC recorded the lowest disease score (10.27) with high yield (3835 kg/ha.).



*Influence of potash on the incidence of blast disease of rice - Effects of split application and time of application (Pattambi)*

Study of the effect of potash application to paddy crop at different times and in split doses in controlling rice blast (under protected and unprotected conditions without any change in the recommended NPK dose) was the object of this trial. It was found that application of potash either as half basal + half at panicle initiation, full as basal or full at panicle initiation stage controlled the neck blast.

*Evaluation of newer fungicides against disease of rice, especially rice blast [Vellanikkara]*

The effect of fungicides on four important diseases of rice, namely, blast, brown spot, sheath blight and stack burn were evaluated. As the disease incidence was very low, the relative efficacy of fungicide could not be assessed properly, under field conditions.

Laboratory studies were conducted as per the technical programme. The efficacy of the fungicide against *Pyricularia oryzae*, *Drechslera oryzae*, *Alternaria padwickii* and *Corticium sasakii* were tested using poison food technique. Complete inhibition of growth (both in liquid and solid media) were obtained in all the concentrations of Agallol. The other fungicides (Hinosan, Kitazin and Panolil in different concentrations) showed varying degrees of inhibition.

In the seed treatment studies, the treated seeds were found to give lesser fungal flora association than the untreated seeds in all periods of storage. Agallol was found to be the best fungicide for seed treatment.

*Yellowing diseases in rice and soil amendment trial (Kayamkulam)*

To find out the cause and the control of the yellowing disease in high yielding varieties of rice, a time of planting trial and a soil amendment trial were conducted. Time of planting trial was conducted for three years from 1977 onwards and the results indicated that none of the treatments had any effect on the control of yellowing. Maximum grain yield was recorded in treatments where the second crop planting for high yielding varieties was done during the first fortnight of August.

*Earhead disease complex trial (Kayamkulam)*

To find out the control measures of earhead disease complex in rice a replicated trial with different pesticides and fungicides was conducted from 1977 onwards. None of the treatments were found to be effective in controlling the disease.

*Replicated trial with Elsan for the control of rice pests (Moncompu)*

The insecticide Elsan 50 EC was evaluated against rice pests in the field. *Baliothrips biformis* was effectively controlled by this chemical at all doses tested. Application of Elsan at 1 lit/ha gave best control of the leaf roller. Elsan was found effective in controlling the stem borer at all doses tested. The insecticide was not effective against Brown Plant Hopper. The plots treated with Elsan @ 1000 ml/ha recorded the highest yield.

### *New insecticide trial - I (Granules) (Pattambi)*

The effectiveness of new granular insecticides against paddy pest complex was studied in this experiment. This trial started during the first crop of 1978-79 was concluded by the first crop of 1980-81. This experiment included different sets of chemicals during each seasons. Furadan 3 G, Ficam 5 G, and Oftanal were found to be the better insecticides against the stem borer. Ficam 5 G, B. H. C., Mocap 5 G. and SAN-155 recorded low incidence of gall midge. Furadan 3 G, Carlin 5 G, BPMC 4 G, MIPC 4 G and Mocap 5 G were the granules effective against the leaf roller. Highest yields were obtained from SAN-155, Furadan 3G and Oftanal. Maximum protection was from BPMC, Ficam, Mocap and Hilbeech treated plots.

### *Effect of NK ratio on BPH incidence and yield of rice (Moncompu)*

The results of pooled analysis of the data collected from this experiment indicated that application of 135kg K<sub>2</sub>O/ha or more induced resistance to BPH.

### *Insect infestation pattern in rice crop in Onattukara area with special referance to rice stem borer (Kayamkulam)*

To get a precise picture of different insects involved, their seasonal occurrence and the factors governing their population, light trap studies were conducted from 1977 onwards. The results of two years observation indicated that stem borer infestation was more during second crop than in first crop. The population of the insect showed an increasing trend from September to November and it reached its peak during the second fortnight of December. Leaf roller attack was observed in June and September-October. Light trap data showed that maximum population of gall midge adults was in the months of November-December. The silver shoot incidence was found maximum during December.

### *Observational trial on Dursban (Moncompu)*

The results of observational trial with Dursban at different doses revealed the insecticide at 10L0ml/ha dose to be effective in the control of gall midge and stem borer.

### *Studies on the cyst nematode of rice in Kerala (Vellayani)*

The project intends to assess the crop loss caused by the cyst nematode on rice, to study its host range and control. The extent of damage was found to increase with increase in population. Height, number of tillers, number of leaves, length of earhead, weight of shoot, root weight and yield of plants were found to be reduced in the inoculated plots. Out of 14 plants tested, only *Echinocloa colonum* was found as a host plant to *Heterodera oryzoicola*. Maximum increase in tiller production, height of plants, number of leaves, shoot weight, yield and 1000 grain weight was observed in plots treated with Phemamiphos followed by FMC, Carbofuran, Aldicarb, Sulfone and Phorate. There was corresponding decrease in nematode population and number of cysts.

*Nematicidal trial against H. oryzae – Effect of nursery soil treatments and seedling root dip (Vellayani)*

The objective of this project is to find out the efficacy of the various popular nematicides in eliminating the nematode infection in paddy by nursery soil treatment and seedling root dips. Results indicated that Carbofuran nursery treatment @ 1 kg ai/ha followed by Dimethoate seedling root dip, nursery treatment with Metham sodium @ 250 l/ha and root dip with Quinalphos (0.2%) significantly reduced *H. oryzae* population and increased the yield by 123 percent.

**ONGOING PROJECTS**

**Crop improvement**

*International Rice Yield Nursery (Pattambi)*

Three trials IRYN (E), IRYN (M) and IRYN (L) were conducted. In IRYN (E) and IRYN (M), the high yielders were on par with the local checks Cul. 1999 and Cul. 1065, respectively. The yield differences in IRYN (L) were not significant.

*Breeding cold tolerant varieties of rice for the high altitude regions of Kerala (Pattambi)*

Seventy three cultures from the crosses IR.8 x CH 1039 and Jaya x CH 1039 were subjected to field screening at the HRS, Ambalavayal. Fourteen cultures, found promising with regard to grain yield and cold tolerance in the seedling stage, were selected for further testing and evaluation.

*Studies on the drought tolerance of first crop (dry sown) rice varieties of Onattukara (Kayamkulam)*

The experiment has been laid out with four varieties of rice.

*Collection, maintenance and utilisation of saline resistant rice varieties (Vytila)*

Thirty saline resistant rice varieties were collected under this project. Seeds of these 30 varieties were sown on the mounds on 21-6-80. Germination of seeds on the mounds was satisfactory in all the varieties. There was a very heavy flood immediately after the sowing which adversely affected the seedlings. There was high rate of seedling mortality, especially in varieties such as Muthiramundakan, Intan, Kuttumundakan and Cheriaorpandi. Transplanting was done on 25-7-80. Twenty varieties flowered during the month of September 1980 and three, in October 1980. The remaining seven second crop varieties flowered in the month of December 1980; but there was no seed setting due to high salinity in the field. Details such as plant height, flowering duration, grain size, 1000 grain weight etc. were recorded. One variety, Ponkuruka, from this collection has been used for a new hybridization programme initiated during the year 1980-81.

### *Screening of rice varieties and cultures for salinity tolerance (Vyttila)*

Sixteen entries selected during 1979-80 were put under yield comparison with four check varieties. The trial was conducted at RRS, Vyttila and repeated in Farmer's fields at Thuravoor and Varapuzha. Sixteen entries and four checks were included in the trial during 1980-81. The crop at Vyttila was very seriously damaged by rain and flood continuously for 37 days from 16-6-80 to 22-7-80. Scoring for survival, tolerance to salinity, duration, plant height and panicle was done. Based on yield, four entries were selected, of which three were tall and one, semi-tall. The details of yield and panicle characters are as follows:

Entry	Designation	Yield (kg/ha)	Av. length of panicle (cm)	Av. No. of grain	Av. wt. (1000 grain)
504	IR 5062	2448	23.5	176	5.31
505	IR 5074	3081	..	...	...
516	C. 23-2-1 (tall)	2255	29.6	210	5.56
507	CSR 4	2205	25.7	135	3.10

The above entries together with IR 5055 were promoted for evaluation of fertilizer response and production potential.

### *Breeding high yielding rice varieties for pokkali area by hybridisation (Vyttila)*

The object was to evolve high yielding, tall, salt resistant varieties suitable for pokkali area by hybridization between popular pokkali varieties such as Vyttila-1, Vyttila-2, Ponkuruka and IR. 5. Seeds of these four varieties were sown during the first crop season of 1980-81. Forty hybrid seeds were obtained from the crosses Vyttila-1 x IR.5, Vyttila-2 x IR.5, IR. 5 x Vyttila-2 and IR. 5 x Ponkuruka. The hybrid seeds were sown at the Rice Research Station, Pattambi to raise the F1 generation during the third crop season. There was considerable variation in plant height (85 to 125 cm) and duration (100 to 130 days) among the F1 plants. Different levels of sterility was noticed and the highest percentage of sterility (95%) was seen in the cross Vyttila-1 x IR. 5. The seeds obtained from the F1 generation were transferred to the Rice Research Station, Vyttila to raise the F2 generation during the first crop season in 1981, leaving a small portion of seeds at the Rice Research Station, Pattambi for maintenance.

### *Hybridization programme-Improvement of pokkali rice (Vyttila)*

Hybridization programme to evolve high yielding rice varieties suitable for pokkali area was initiated during the year 1968 by taking crosses between pokkali and T(N) 1. Two cultures Cul. 5-1 and Cul. 4-4 selected from this programme were under a comparative yield trial

during 1980-81. The trial was repeated in cultivators' field also. Though the yield difference was not statistically significant, the highest yield of 3155 kg/ha was recorded by Cul. 4-4 which was followed by Cul. 5-1 having a yield of 2786 kg/ha while the yield of the control Vyttila-1 was 2480 kg/ha. A preliminary yield trial was conducted with nine cultures from the cross pokkali x Jaya, with Vyttila-1 as the control, during the cropping season in 1980. Various plant characters such as flowering duration, height of plant, grain yield etc. were recorded. On the basis of yield and other characters, five cultures namely, Cul. 4, Cul. 11, Cul. 43, Cul. 20 and Cul. 53 were selected for further trials during the next cropping season.

*Breeding high yielding varieties of rice for saline areas of Kerala-Irradiated materials of Odacheera (Mannuthy)*

The experiment was started with a view to evolving high yielding saline resistant varieties from the popular Odacheera variety, through gamma irradiation. The selected materials of M5 generation were raised during the period under report and the seeds were collected. Further work in this project will be done at the Rice Research Station, Vyttila.

*Breeding lodging resistant, fertilizer responsive, medium tall rice varieties suited for dry sown virippu season in upland of Kerala (Pattambi)*

The medium tall culture 1907 was yield tested in the uplands. Sixty new cultures were screened. Progeny of the cross 1907 x Jyothi were grown in pedigree rows. Cul. 1907 was found to be suitable for uplands. Eight entries could be selected for further testing. Fifteen red kernelled and medium tall selections have been identified. The selected cultures are to be yield tested in uplands next year.

*Breeding of improved rice varieties for the ill-drained and temporarily flooded areas of Kerala (Pattambi)*

A total number of 296 varieties and cultures were screened giving a week's submergence one week after planting, maintaining a water level of 30 cms. Three (Cul. 25333, H4 and Malinge) were identified as promising. The selected lines will be further tested and new collections will be screened.

*Project for studying the growth and production of paddy as influenced by the changing environmental conditions (Moncompu)*

Four high yielding varieties, MO-4, Jaya, Jyothi and T (N) 1, were taken as the test varieties. They were sown every fortnight and were transplanted. Observations on plant height, productive tillers, duration, spikelet sterility and yield of grain were recorded.

*Evolution of high yielding photosensitive varieties suited to the different agro-climatic zones (Moncompu/Kayamkulam/Mannuthy)*

From the F3 and F4 generation cultures planted at the Rice Research Station, Kayamkulam, single plant selections were made from the

crosses Jaya x Ptb-20, Jaya x Ptb-4 and Ptb-4 x TR-17. The F4 cultures planted at Mannuthy suffered drought during the last phase and hence proper selections could not be made. However, some selections were made from Jaya x Ptb-12, Jaya x Cochin-1, MI-273 x Cochin-1 and MI-273 x Ptb-12.

*Evolution of high yielding photosensitive varieties of rice suited to different agroclimatic zones (Kayamkulam)*

The objective was to evolve high yielding semi-tall photosensitive varieties suited to the second crop season of Onattukara. Selection work of the cultures, from F2 to F6 generations, was conducted at the Rice Research Station, Moncompu involving different cross combinations with a photosensitive variety as one of the parents. The following selections were made based on photosensitivity, flowering duration, height (medium tall), good plant type, higher yield and resistance to pests and diseases.

F5 generation:

Jaya x Ptb-4	—	17 selections
Jaya x Ptb-24	—	99 ..
Ptb-4 x TR-17	—	44 ..

F4 generations;

MI-273 x UR-19	—	33 selections
MI-273 x Ptb-20	—	12 ..

The selection work and further trials will be continued for obtaining suitable high yielding varieties for the second crop season in Onattukara.

*Breeding high yielding, tall, photosensitive rice varieties with good straw yield specifically suited for the mundakan season of Kerala (Pattambi)*

New crosses involving Co-25, Ptb-20 and Kottarakkara-1 on the one side and H4, Mashoori and Jagannath on the other were got effected at the IRRRI under a collaborative programme. A red kernelled rice culture 25100 was yield tested with Cul. 31-1 of Kayamkulam and three checks. One hundred and thirty nine single plant selections from crosses involving Co-25 were grown. Cul.25100 was on par with Cul. 31-1 and Kottarakkara-1 in grain and straw yield. Sixty three plants from crosses involving Co-25 could be selected. Cul.25100 and other promising cultures are to be yield tested.

*Evolution of varieties having intermediate height suited to broadcast conditions in Onattukara (Kayamkulam)*

To study the comparative yield performance of five Pattambi cultures having intermediate height under broadcast conditions, a CYT was conducted with two standards. The treatment effects were not significantly different. Maximum grain yield (3954 kg/ha) was recorded by Jyothi. followed by Cul. 1023 (3540 kg/ha). During 1979-80, the treatments were significant for grain yield. Maximum grain yield was recorded by Cul.1004 (4604 kg/ha).

### *Evolving a short duration semi-tall variety of rice (Moncompu)*

Eleven F8 cultures were grown in additional crop season 1980 and all of them were carried forward to punja season. Nine F6 cultures were also grown in additional crop and five were selected for growing in punja season as F7. The four single plants selected from the five cultures will be put under yield trial during next year.

### *Breeding of high yielding short duration varieties of rice suited to first crop season having resistance to drought and tolerance to pest and diseases (Kayamkulam)*

A C Y. T. with four selected cultures of cross Cul. 16 x Triveni and one culture of cross Tadukkan x Jaya was conducted. The treatments were significant for grain yield. Maximum grain yield (4908 kg/ha) was recorded by Cul. 52-3-6, followed by Cul. 54-1-3 (4626 kg/ha) and Cul. 43-1-4 (4522 kg/ha). The cultures were superior and early to Jyothi.

During 1979-80, maximum grain yield of (2861 kg/ha) was recorded by Cul. 43-1-6, followed by Cul. 26-1-1 (2760 kg/ha.).

### *Breeding for earliness in varieties H4 and SR 26 B by induced mutations (Vytila)*

The object was to reduce the duration in rice varieties H4 and SR 26 B by using physical and chemical mutagens. Seeds of H4 variety were exposed to gamma rays at three different doses (10, 20 and 30 KR). Another set of H4 seeds was treated with Ethyl Methyl sulphonate (EMS) solution at four concentrations (0.5%, 1.0%, 1.5% and 2.0%). Two hundred seeds were treated with EMS solution under each concentration. None of the seeds germinated under higher concentrations, while the percentage of germination at 0.5% and 1.0% was 68% and 4%, respectively. The germinated seeds were sown and the resultant plants harvested separately. M2 generation will be raised during the cropping season in 1981.

### *Breeding for earliness in the variety Mashoori by induced mutations (Vytila)*

One hundred and twenty five plants were selected from the M2 generation raised during 1979 and seeds of these 125 plants were sown in the field. A portion of seeds was sown in a cultivator's field at Chittor. The germination of seeds in both the locations was very good; but the entire crop was destroyed by flood. Resowing was done. The plants started flowering from 7-10-80 and plants that flowered upto 23-10-80 were marked. Six plants were harvested on 12-11-80, five on 24-11-80 and five on 4-12-80, while the control Mashoori was harvested on 10-12-80. All the remaining cultures were rejected because they were having a duration of Mashoori or more. The selected cultures had a duration of 115 to 136 days. These cultures have to be further studied during the next cropping season in 1981.

*Genetic studies on induced viable mutants in rice (Vellayāni)*

Seeds of three tall indica varieties Ptb.9, 10 and 28 were treated with mutagens. A total of 41 morphological mutants (Ptb-9, 16; Ptb-10, 15; Ptb-28, 10) were isolated in the M2 generation.

*Exploration of high protein strains from hill paddy varieties and other local strains (Mannuthy)*

A germplasm bank comprising of 378 varieties were maintained at the Station for further studies.

*Pest and disease resistance breeding (Mannuthy)*

Based on the performance at Pattambi, six cultures were selected. These cultures will further be tested in comparative yield trials.

*Breeding of varieties of rice resistant to BPH (Moncompu)*

The forty two F8 culture selected during 1979-80 were put in replicated trials during the two seasons of 1980-81. They were grouped into three, based on the duration. Yield trials will be conducted during next year.

*Inheritance studies on BPH resistance in Ptb-19, Ptb-33 and ARC 6650 (Moncompu)*

During 1980, the screening could not be taken up, as it was not possible to rear BPH to test the F2 cultures. Fresh crosses are proposed to be taken up.

*Breeding for disease resistance in rice with special reference to sheath blight and stack burn (Pattambi)*

Eleven cultures selected in 1979-80 were screened at the State Seed Farm, Adoor, endemic to the sheath blight disease. Two cultures 1949 and 1954 showed good resistance and these have been selected for future yield testing.

*National screening nursery-1 (AICRIP, Moncompu)*

The trial was carried out in two replications. One was inoculated by means of viable *sclerotia* as well as by infected stem pieces. Sheath blight was observed from this replication. The other replication was utilised for scoring sheath rot disease. The disease pressure in general was low during the season.

*National screening nursery-2 (AICRIP, Moncompu)*

The trial was carried out in two replications. The first replication was utilised for screening BLB and the other for scoring sheath rot. The coded data has been sent to AICRIP, Hyderabad.

*Screening of rice varieties against important diseases (Moncompu)*

The results of the trial showed that in the additional crop season, 15 cultures were completely free from BLB and 29 varieties from sheath blight attack. Ten entries had no sheath rot attack. During the punja season, the incidence of all the three diseases was very low. Only a few varieties were found affected by the diseases.



### *Gall midge screening trial (Pattambi)*

Out of 59 entries tested, 17 were found to be completely free from gall midge attack.

### *Screening of rice varieties suited to different seasons in Onattukara from the existing high yielding varieties of paddy under recommended package of practices (Kayamkulam)*

From the screening trials conducted during 1977, fifteen varieties were selected for the first crop season and nine for second crop season. In the CYT of 15 first crop varieties conducted during 1980-81, maximum grain yield (5202 kg/ha) was recorded by Cul.16 followed by Ptb-23 (4514kg/ha), ARC-11980 and IR-32. The difference in the treatments were found statistically significant. During 79-80, maximum grain yield (4306 kg/ha) was recorded by ARC-11980 followed by Annapurna, Triveni and Ptb-23. The treatments were significantly different. The trial will be continued during 1981-82 for confirmatory results.

In the CYT of nine second crop varieties conducted during 1980-81, treatment effects were significant. Pankaj recorded maximum grain yield (3077 kg/ha) followed by Mashoori (2533 kg/ha) and Jagannath (2400 kg/ha). During 79-80 second crop also, the treatment differences were significant. Maximum grain yield (3057 kg/ha) was recorded by Blue Bonnet which was on par with H4 (2900 kg/ha), Pankaj (2737 kg/ha) and Jagannath (2581 kg/ha). The trial will be continued for confirmatory results.

### *Adaptive trial of pre-release cultures (Operational Research Project, Moncompu)*

Three promising cultures (1537-1, 1544-2 and 1999) along with Jyothi as check were put under trial at four locations to assess their yield potential and tolerance to pest and diseases. The result indicated that the three cultures were significantly superior to Jyothi in yield (4520, 4932 and 4948 kg/ha, respectively as against 4068 kg/ha for Jyothi). Cul.1544-2 showed tolerance to BPH. Sheath blight score was low in 1544-2 and 1537-1.

### *Varietal trial on paddy (Ambalavaya)*

The objective is to compare the yield potential of Wynad varieties and to maintain the germplasm. Fifty six local varieties were collected, out of which 23 varieties were selected based on yield. During 1980-81 the maximum yield was given by Peruvaya (4.465 kg in a 4 m<sup>2</sup> plot).

### *Preliminary variety trials (Pattambi)*

The trials, PVT-1 and PVT-2, were conducted with 40 and 49 entries, respectively. IET 6983 in PVT-1 and IET 7282 in PVT 2 recorded the highest yield.

### *Uniform variety trial (Pattambi)*

Five trials (UVT 1, 2 and 5 in virippu and UVT 3 and 4 in mundakan) were conducted. In the UVT-1, the local Check Cul. 1999 recorded the

maximum yield. In UVT 2, the yield differences among the entries were not significant. In UVT-5, the highest yield was recorded by the variety IET 5883. The highest yielder in UVT-3 was on par with the check variety Jaya.

*Uniform variety trial-1 (Mannuthy)*

The object of the experiment was to evaluate the comparative performance of very early maturing selections. The highest yield was recorded by culture of the cross, Balax Co-13.

*Uniform variety trial-2 (Mannnthy)*

The object of the experiment was to study the comparative performance of early duration varieties. This experiment consisted of 15 treatments and the entry No. 204 (IR,22 x TN.1) registered the maximum grain yield (4042 kg/ha). This was followed by the entry No.211 (Kumarx Bala), with a grain yield of 4036 kg/ha

*Uniform variety trial-3 (Mannuthy)*

This experiment was conducted with 18 treatments in three replications with a view to study the comparative performance of early duration varieties. The results showed that Pankaj x Vijaya recorded the maximum grain yield of 6233 kg/ha.

*Uniform variety trial-4 (Mannuthy)*

The experiment aimed to study the comparative performance of 14 late duration varieties. The entry No. 407 recorded a grain yield of 5667 kg/ha followed by the entry No. 408 (5076 kg/ha.)

*Uniform variety trial-1, Kharif (Mannuthy)*

The object of the experiment was to evaluate the comparative performance of very maturing selections. The variety Bala registered the maximum grain yield of 5758 kg/ha, followed by Balax Co.13 (4405 kg/ha)

*Uniform variety trial-2, Kharif (Mannuthy)*

This experiment aimed at the study of comparative performance of early duration varieties. Highest grain yield recorded in the experiment was 3027 kg/ha by the entry No. 212,

*Uniform variety trial-3 Kharif (Mannuthy)*

This experiment consisted of 18 treatments studied the comparative performance of early duration varieties. Among the various cultures tried, cultures 310 and 314 were found promising.

*Preliminary variety trial- 1 Rabi (Mannuthy)*

The object of this experiment was a preliminary assessment of the comparative performance of promising early duration varieties. Out of the 40 tried in this experiment, entries 623 and 624 were found promising,

*Preliminary variety trial-3, Rabi (Mannuthy)*

The objective of this experiment was a preliminary assement of the yield performance of promising medium duration varieties. Out of the 64 tried in this experiment, maximum yield was recorded by entry No. 859 (5325 kg/ha).

*Preliminary variety trial-1, Kharif (Mannuthy)*

This experiment was aimed to evaluate the performance of very early maturing selections. Out of the 49 cultures tried, entries 531 and 510 were promising.

*Preliminary variety trial-2, Kharif (Moncompu)*

The objective of this experiment was to evaluate the performance of early maturing selections. There were altogether 59 treatments in this experiment. Of these, entries 750, 760 and 724 were found promising.

*Evaluation of new cultures of rice evolved at the Colleeo f Agriculture, Vellayani (Karamana)*

The performance of the pre-release cultures from the College of Agriculture, Vellayani (Cul. 47-41. Cul. 28-26 & Cul. 24-20) are studied in relation to that of Annapoorna. This experiment was started during kharif 1978-79. The kharif crop was harvested on 11-8-80 and 20-8-80. Harvest of rabi experiment was completed on 15-1-1981.

During kharif, Cul. 41-41 yielded 3834.42 kg/ha at 75 kg/ha at 75 kg N/ha followed by Cul. 28-26 at 90kg N/ha with 3765.20 kg/ha yield. Annapoorna recorded an yield of 3723.68 kg/ha at 90 kg/ha.

The yield data of rabi season showed that Cul. 47-41 was recording higher yields than Annapoorna, No. 28-26 and No. 24-20. Culture No. 47-41 gave 2713.16 kg/ha at 60 kg N/ha and 2685.48 kgN/ha at 45kgN/ha Culture No. 28-26 showed an yield of 2685.48 kg at 45 kgN/ha.

*Comparative yield trial on rice (Manuuthy)*

A comparative yield trial comprising of 11 cultures and two local check varieties was conducted during the period under report. Maximum yield was recorded by the culture 2019 (3555 kg of grain/ha), followed by the culture 2260 (3528 kg/ha). The experiment will be repeated for drawing definite conclusions.

**Crop management**

*Studies on the methods of sowing in paddy (Mannuthy)*

The aim of the experiment was to find out the effect of different methods of sowing as compared to transplanting. The experiment consisted of four treatments and the results of the virippu season showed that there was no significant difference on the yield of grain and straw, between the various treatments.

*Experiment on method of sowing (Moncompu)*

Results of the different methods of sowing/planting of rice revealed no significant difference between the normal transplanting, Dapog method of raising nursery and transplanting, or dibbling.

*Influence of seedling age on the growth and yield of rice (Vellayani)*

The experiment was laid out to study the effect of seedling age on the growth and yield of rice varieties like Mashoori, Pankaj and H4 as influenced by different spacing. The study revealed that in the case of Mashoori, 5, 6 and 7-week old seedlings were superior in yield of grain compared to 3 and 4-week old seedlings. The effect of spacing was not significant. Highest yield was obtained when the spacing was 15 x 10 cm and the seedling age, 7 weeks. In Pankaj, 3, 4 and 5-week old seedlings and spacing of 20 x 20 cm gave the highest yield. There was no significant difference between age of seedlings and between spacings. In H4, 6-week old seedlings recorded highest yield of grain and were on par with 5 and 4-week old seedlings. There were no significant difference between the spacings.

*Studies on the time of planting in paddy (Mannuthy)*

The aim of this experiment was to find out the effect of date of planting and different agro-meteorological factors on the yield of rice during the three seasons. Four medium duration and four short duration varieties were tried in this experiment. The experiment is in progress.

*Project for studying the growth and production of paddy as influenced by the changing environmental conditions (Moncompu)*

Four high Yielding varieties (MO 4, Jaya Jyothi and T (N) 1) were planted each fortnight and observations on plant height, number of productive tillers, duration for flowering, spikelet sterility and yield of grain recorded.

*Technology of manuring rice in flooded soils (Vytila)*

It was observed that when the experiments were conducted in small plots in pokkali, the crop performance and yield were substantially reduced. This may be due to variation in oxidation-reduction potential caused by reduced water movement.

*Permanent manurial trial (Kayamkulam)*

The trial was conducted from 1964 to 1970 with tall *indica* and from 1971 onwards with dwarf *indica* Jaya. During the first crop season 1980-81, maximum grain yield (2530 kg/ha) was recorded by treatment No. 7 (80kgN/ha-60 kgN/ha as ammonium sulphate and 20 kgN/ha as cattle manure + 40 kg each of  $P_2O_5$  and  $K_2O$  as super phosphate and muriate of potash), followed by treatment No.1 (80 kg N/ha as cattle manure).

During the second crop season also, the treatment effects were significant. Maximum yield was recorded by T7 (2469 kg/ha) which was on par with T1.

The results of the Permanent Manurial Trial conducted at the station from 1964 indicate that in sandy tracts of Onattukara application of cattle manure to supply 24% of the total recommended dose

of nitrogen together with the balance nitrogen + recommended dose of  $P_2O_5$  and  $K_2O$  as fertilizers gave maximum yield during first crop season. During the second crop season, application of the entire dose of nitrogen as cattle manure even without  $P_2O_5$  and  $K_2O$  recorded the maximum rice yield. Continuous application of nitrogen in the form of fertilizers without  $P_2O_5$  and  $K_2O$  may have deleterious effects.

*Permanent manurial trials with tall & dwarf Indica (Pattambi)*

Experiments with Ptb-2 during the first crop season and with Ptb-20 during the second crop season were laid out for the tall *indica* series. For dwarf *indica* series, Jaya was grown during both seasons. Grain yield, straw yield and ancillary data were recorded and analysed. Soil samples were also analysed for finding out the treatments on nutrient status.

*Long range effect of continuous cropping (AICARP, Karamana)*

This experiment has to be conducted for 12 years at the same site with the same layout plan and treatments. The kharif and rabi season experiments were successfully completed during the period under report. The kharif crop was harvested on 22-9-80 and the rabi crop, on 30-1-81.

*Monitoring soil fertility and crop productivity under continuous rice culture (AICRIP, Pattambi)*

The experiment was conducted during first and second crop seasons. The application of nitrogen showed significant influence in increasing the grain yield, while phosphorus and potash had no significant influence on yield.

*To study the optimum level of NPK for rice in sandy tracts-different ratios (Kayamkulam)*

To study the optimum level of NPK for rice in sandy tracts, a trial was conducted from 1979 second crop season. During 1980-81 first crop, the treatments were not significant for grain or straw yield. Maximum grain yield of 3400 kg/ha was recorded by  $T_3$  (NPK-90:90:90 kg/ha ie, 2:2:2), followed by  $T_5$  (NPK-45:22.5:22.5 kg/ha ie, 1:0.5:0.5) with 3200 kg/ha.

*Effect of different ratios and levels of N, P and K on maximisation of yield of rice in the sandy loam tracts of Onattukara (Vellayani/Kayamkulam)*

The study was conducted to investigate the effects of different ratios of N, P and K on growth and yield of second crop rice in Onattukara, to study the effect of graded doses of nitrogen in combination with different levels of P & K in sandy loam soils, to study the uptake of major nutrients as influenced by different levels & ratios of

NPK, and to work out the optimum combination of these nutrients for maximum yield. The field work has been completed and the data on yield attributes are being analysed.

*Response of rice to split application of N & K at different growth phases (Chalakudy)*

The objective of this experiment was to find out the response of split application of nitrogen and potash at various growth phases of rice. The analysis of data on grain yield showed that the treatment effect was not significant.

*Split application of phosphorus for rice (Chalakudy)*

This experiment was aimed to find out the effect of split application of phosphorus to rice in sandy loam soil. The results of the first and second crop seasons of 1980-81 indicated that neither the dose nor the split application of phosphorus had any influence on grain yield.

*Trial with Phospal (AICARP, Karamana)*

This experiment is conducted to study the relative efficiency of Phospal as a fertilizer material in comparison with superphosphate. The experiment was started in kharif 1980-81 and was conducted during rabi and summer also. The kharif and rabi crops were harvested on 1-11-1980 and 26-2-81, respectively.

*Nutrio-periodism of potash in medium duration rice varieties (AICARP, Karamana)*

Both the kharif and rabi experiments were successfully completed during the period under report. The kharif crop was harvested on 6-10-1980 and rabi, on 25-2-81. The data was sent for analysis.

*Economics of crop sequences and their effect on soil productivity over years (AICARP, Karamana)*

The experiment was conducted during the summer season (3rd crop) of 1979-80 and during kharif, rabi and summer seasons of 80-81. The kharif crop was harvested on 18-9-80 and rabi crop, on 24-1-1981. This is a continuing experiment.

*Low cost production technology in rice (Chalakudy)*

This project was aimed to find out the possibility of substituting chemical fertilizers with indigenous organic manures to reduce the input cost. One season of study showed that the effects of treatments were not significant.

*Response of Cul. 31-1 to graded doses of fertilizers (Vellayani| Kayamkulam)*

The aim of the experiment was to study the performance of the culture to different levels of N,P and K. The field work has been completed. Observations taken on yield characters and yield of grain and straw are being analysed.

*Performance evaluation of promising medium duration rice cultures under low NPK levels (Pattambi)*

The experiment was conducted during virippu and mundakan seasons. IR 42, Cul. 1-5-4 and Cul. 1065 produced the highest grain yield at 40-20-20 kg/ha NPK during both the seasons.

*Agronomic evaluation of new promising pre-release or newly released varieties of cereals (AICARP, Karamana)*

The treatments in the experiments are combinations of dates of planting, levels of nitrogen and varieties. The experiment was conducted during rabi 1980-81 and the crop was harvested on 9-2-81, 3-3-81 and 17-3-81, depending on the treatments. The data on yield and biometric observations were sent for analysis.

*Nitrogen management of short duration rice cultures 24-20 and 47-41 (Karamana)*

The experiment was started during kharif 1980-81. Because of the uneven stand of Cul. 47-41, the experiment was harvested as a bulk crop during kharif. The rabi crop was harvested on 12-2-81. Cul. 47-41 is found to be better than No. 24-20. Cul. 47-41 gave an yield of 4108.34 kg at 75 kg N/ha [applied in two split doses-2/3 as basal and 1/3 top dressing. The yield was 3961.47 kg when 45 kg N was applied in two split doses-2/3 as basal and 1/3 top dressing.

*Nitrogen economy through organic manure (AICARP, Karamana)*

The kharif and rabi season experiments were harvested on 18-10-80 and 28-2-81, respectively. The data had been sent to I. A. S. R. I. for analysis.

*Increasing fertilizer nitrogen efficiency in low land rice (AICRIP, Pattambi)*

The experiment was conducted during the first and second crop seasons. Application of nitrogen in the form of sulphur-coated urea and urea super granules increased the nitrogen use efficiency.

*Utilization of non-edible oil cakes in increasing the nitrogen use efficiency of rice (Vellayani)*

The experiment was conducted to evaluate the comparative efficiency of neem, maroti and rubber seed oil cakes in increasing the efficiency of urea in rice. The study revealed that mixing oil cakes with urea in different proportions and different levels of nitrogen had no significant effect on the yield of paddy. However, maximum yield was obtained when urea and oil cakes were mixed at a ratio of 5:3.

*Effect of coaltar treated urea on the yield of rice under wet land conditions (AICRIP, Pattambi)*

The experiment was conducted during the first and second crop seasons. There was no significant difference in grain yield by coating urea with coal-tar.

*Studies on geometry of placement of urea super granules at different levels of plant population in transplanted rice (AICRIP, Pattambi)*

The experiment was conducted during virippu and mundaken seasons. The result from the first crop was vitiated due to severe attack of BPH. During the second crop, the treatment with placement of 2g granules/4 hills with a spacing of 20 cm x 15 cm recorded the highest grain yield.

*Nitrogen economy in rice through algal fertilizer in different soil type and soil physical conditions (Kayamkulam)*

A multilocation trial was conducted to verify the efficacy of blue green algae in various agroclimatic regions. During 1980-81 first and second crops, the treatment effects were not significant. During the first crop maximum yield (3049 kg/ha) was recorded by treatment No. 4 (NPK 30:45:45 kg/ha + blue green algae @ 10 kg/ha), followed by treatment No. 2 (NPK 60:45:45 kg/ha + blue green algae @ 10 kg/ha) with 2998 kg/ha and treatment No.5 (NPK 30:45:45 kg/ha) with 2922 kg/ha

During second crop 80-81, maximum yield was recorded by treatment No. 4, followed by treatments 1 & 2.

*Nitrogen economy in rice through algal fertilization (Moncompu)*

The addition of blue green algae did not show any effect on economising nitrogen, so far as the grain yield was concerned.

*Nitrogen economy in rice through algal fertilisation in different soil types and soil physical conditions (Chalakydy)*

A multilocal trial was conducted to verify the efficiency of blue green algae in various agro-climatic regions of the State and to standardise the methods of multiplication of blue green algal culture under the condition existing in Kerala. Results showed that there was no significant difference in grain yield due to algal inoculation.

*Combined use of nitrification inhibitors and blue green algae for economising nitrogen inputs under Kuttanad conditions (Moncompu)*

Combined use of blue green algae and nitrification inhibitors along with graded doses of nitrogen did not show any significant difference.

*Utility of azolla as a partial substitute to inorganic nitrogen fertilizer for wet land rice culture (Kayamkulam)*

The results indicated that treatment effects were not significant. However, maximum grain yield (2112 kg/ha) was recorded by treatment No. 3 (recommended dose of N + azolla @ 5 tonnes/ha) and treatment No. 9 (75% recommended dose of N, without azolla) with 2105 kg/ha.



*Weed control for direct sown rice in puddled soils (AICRIP, Pattambi)*

This experiment was conducted during virippu and mundakan seasons. The mundakan crop failed due to scarcity of water. During first crop season, the herbicides-Oxyfluorfen showed high weed control efficiency. Oxyfluorfen at low concentrations (0.1 kg ai/ha offers good scope for weed control.

*Weed control trial for direct sown rice under puddled condition (Moncompu)*

The experiment commenced during the punja season of 1980-81. Oxydiazon (G) @ 0.75 kg ai/ha gave best weed control as compared to other chemical treatments. With regard to grain yield, chemicals like Oxyfluorfen (G), 2,4-D, EE (G) and Basaline (G) at lower rates along with one hand weeding 25 days after sowing and Oxydiazon at lower rate were found to be equally effective as hand weeding or weed free check.

*Weed control on transplanted rice (Moncompu)*

The highest grain yield was recorded by 2, 4-D at the rate of 0.8 kg ai/ha, followed by Basaline (L) @ 0.8 kg ai/ha.

*Studies on the critical periods of weed infestation and effect of weed growth on yield and quality of a short duration direct sown rice under semi-dry conditions (Vellayani)*

An experiment was conducted to find out the critical period of crop-weed competition, proper time for weed control, etc. with reference to direct sown, short duration rice.

*Effect of combined application of 2, 4-D and urea in controlling weeds and also on the yield of rice (Vellayani & Moncompu)*

The aim of the experiment was to study the effect of combined application of 2, 4-D and urea in controlling weeds and to assess its influence on yield. The experiment was conducted both in transplanted and direct sown crops.

*Combined application of 2, 4-D and urea (Moncompu)*

The results of the experiment showed that combined application of 2, 4-D sodium salt (W.P) (Feroxone) and urea was as good as spraying 2, 4-D sodium salt and applying urea separately for weed control and grain production.

*Compatibility of 2, 4-D & Propanil and the effectiveness in controlling weeds in paddy (Moncompu)*

The result of the experiment showed that 2, 4-D and Propanil were compatible when both were applied at half the recommended dose (Propanil at the rate 1 kg ai/ha and 2, 4-D at 0.5 kg ai/ha).

*Use of common salt to prevent post harvest deterioration of paddy grains due to inclement weather conditions in the rice tracts of Kuttanad (Moncompu)*

Out of the different treatments, dipping the seeds in 7% salt solution appeared to be the best.

*Crop response to micronutrients – Paddy (Moncompu)*

Significant increase in the yield of paddy was obtained during the first season by the soil application of  $ZnSO_4$  @ 40 kg/ha or  $CuSO_4$  @ 20 kg/ha as well as by soaking of seeds in 2%  $ZnSO_4$  solution. But negative response was noted for micronutrient application during the second crop season.

*Crop weather studies (Pattambi)*

Four short duration and four medium duration varieties were sown at fortnightly intervals, transplanted all through the year and their performance studied. A total of 19 sowings from 3rd May to 28th June during virippu (Bharani and Thiruvathira nhattuvela) and 26th July to 17th October (Pooyam to Chithira nhattuvela) for mundakan were done for both short and medium duration group. During punja, seven sowings from 8th December to 25th February (Thrikketta to Chathayam nhattuvela) for short duration and ten sowings for medium duration (omitting the last two sowings) were done. Observations on flowering, tiller count, 1000 grain weight, volume/weight of grains, chaff %, grain and straw yield for each sowing were recorded.

**Plant protection**

*Strain variation in *Rhizoctonia solani* Kuhn, *Thanatephorus cucumeris* (Frank) Donk, causing sheath blight of rice (Vellayani)*

The main objective of this project was to determine the variation among the isolates of *Rhizoctonia solani* from rice and the collateral hosts. Screening of rice varieties was done to identify those resistant to various isolates. Different isolates of the organism were brought into pure culture. Studies were done on the morphological and cultural characters of the isolates.

*To evaluate new promising fungicides in controlling sheath blight disease (Moncompu).*

The environment was not congenial for the development of the disease. Sheath blight appeared quite late in the experimental plots and the disease pressure was extremely low. The data on intensity of sheath blight and yield of grain were recorded.

*Studies on the control of sheath blight of rice (Vellayani)*

The results of one of the series of this multidisciplinary experiment showed that soil application of Zn and Mn significantly reduced the percentage of infection and the intensity of the disease.

The second series of experiments showed that Hinosan spray was very effective in controlling the disease. 2:2 ratio of nitrogen and potash application significantly reduced the intensity of the disease.

The third series of experiments revealed that Vitavax spray followed by Thiride spray, Benthocarb application, Hinosan spray and soil application of Zn reduced the incidence of the disease.

*Control of sheath blight disease of rice with new chemicals (Pattambi)*

This experiment was aimed at controlling the severity of the disease by the application of new chemicals including a herbicide spraying. Due to low disease pressure during both the [seasons, efficiency of the chemicals could not be evaluated properly. Spraying of Brassicol W. P., thirty days after planting showed slight decrease in disease intensity.

*Chemical control of sheath rot of rice AICRIP, (Moncompu)*

The effect of fungicides on the intensity of sheath rot and grain yield were recorded. The results showed that sheath rot was lowest in the plots treated with Bavistin. In general, the disease pressure was extremely low during the cropping season.

*Bacterial leaf blight of rice—Studies on pathogenic variability, screening for disease resistance and chemical control (Vellayani/Pattambi)*

Since the occurrence of the disease was erratic, collection of isolates from different rice growing tracts of the State was not possible and therefore studies on variability of the bacterium could not be taken up.

*In vitro* screening of six antibiotics showed that Terramycin 250 ppm was effective against the pathogen. Survival studies of the pathogen on seed and plant debris was undertaken. It was noticed that the pathogen is both internally and externally seed borne.

*Studies on the udbatta disease of rice (Ambalavayal)*

The study aimed at determining the mode of infection, collateral hosts, life cycle of pathogen and at evolving suitable control measures. Field control of the disease could not be taken up as field incidence of the disease during the year was negligible. Three weed hosts collected from the field bunds and adjoining areas were sent to Director, National Herbarium, Howrah. They were identified as *Paspalum orbiculare* Forst, *Eragrostis nigra* Nees and *Alloteriosis cimicina* stapt. Only the conidial stage of pathogen *Ephelos oryzae* was noticed in these weed hosts resulting in the emergence of erect panicles covered with the sporodochia containing numerous conidia.

*Studies on the copper shyness in rice varieties and the effect of copper fungicides in rice disease control (Pattambi)*

The object of the experiment was to evaluate the efficiency of Bordeaux Mixture and Fytolan in controlling rice diseases, to assess their

influence in yield and also to determine phytotoxicity (if any) of copper on high yielding dwarf *indica* rice varieties. Out of eleven varieties tested, the unprotected plots of Rohini, Annapoorna, Jyothy, Bharathi, Aswathy, Jaya, Sabari and Mashoori recorded higher yield than the treated plots. Visual rating for phytotoxicity showed that both Fytolan and Bordeaux Mixture produced leaf scorching symptoms on Rohini, Ptb-10 and Annapoorna. Bordeaux Mixture produced brown rusty spots on varieties like Annapoorna, Bharathi, Aswathy and Jaya. Jyothy and Sabari did not show any phytotoxic symptoms when sprayed with either of the two chemicals

*Epidemiological studies on important rice diseases in Kuttanad (Moncompu)*

The appearance of BLB in rice was closely related to meteorological factors (high humidity and scanty rains. (The intensity was more in T (N) 2 and Jyothi than in Jaya and Bhadra. Maximum sheath blight score was found in Jyothi and Jaya

*Forecasting of BPH & stem borer of paddy in Kuttanad (Moncompu)*

The stem borer counts during the virippu and punja seasons indicated the incidence is low during virippu and high during punja. There was no incidence of BPH during virippu season. BBH incidence started in February during the punja season and reached the maximum by the middle of March

*BPH biotype studies (Moncompu)*

It was observed that all the plants in varieties T (N) 1 and IR-36 succumbed to leaf hopper attack, while all the plants of the varieties Ratu Hee Nati and PTB-33 survived. In IET-6350, 25% of the plants were dead while in IR-26, the death rate was 75%

*Collection and identification of paddy pests and their natural enemies (Moncompu)*

During the year under report, two insect pests, viz., leaf feeding gryllid (*Euscyrteius corcinnus*) and paddy black bug (*Scotinophora sp.*) were observed in Kuttanad.

*Estimation of losses due to insect pests (Pattambi)*

The objective of this trial was to estimate avoidable loss due to insect pests at different stages of crop growth by adopting suitable protection techniques. The trial included eight treatments in the first crop and five in the second crop seasons. During the first crop season; all the treatments were alike in controlling gall midge and stem borer, but against leaf folder, it was observed that the chemical control given at later stages of crop growth reduced the infestation. Projection from the late tillering stage of the crop increased the yield and will be more economical. The pest incidence was comparatively low during the second crop season. Hence confirmatory results could not be obtained, even though slightly higher yield as obtained in the plots protected from planting till harvest.

### *Pest management trial (Pattambi)*

The project was to test the efficacy of different methods of pest management in relation to resistant and susceptible varieties. The pre-scheduled pest management was found to be better in all the varieties tested against stem borer, gall midge and leaf folder attack. The varieties RPW 6-17 and IET 6238 were tolerant to the gall midge. Highest yields were obtained from the varieties IET-6238 and Jaya. On comparison between treatments, pre-scheduled management and management on need basis yielded equally.

In the second crop season, the variety Jaya was better than the others against the stem borer. RPW 6-17 was better against the gall midge, even without the application of chemicals. The variety Jaya was highly susceptible to brown plant hopper attack. Pre-scheduled management was the best treatment against all the pests and also to obtain higher yields. As regards yield, Jaya, Cul. 1-5-4 and RPW 6-17 were on par.

Eventhough pre-scheduled pest management was found superior in controlling rice pests than need based pest management, the latter is more economic and gives an additional income of Rs.907/ha for first crop and Rs.305/ha for the second crop.

### *Pest management trial (Moncompu)*

Stemborer and BPH were the major pests observed in the plots. Regarding the insecticide treatments, need based application of Dursban twice, was effective.

### *Economic insect pest control trial (Pattambi)*

This trial was to evolve economic methods or insecticidal application in controlling rice pests. The experiment included eight treatments in the first crop and 12 in the second crop. Against gallmidge during first crop, "maximum protection treatment" was the best in controlling the pest. The stem borer and leaf folder incidence was least in the treatments "seedling root dip in Dursban + Cytrolane @ 0.5 kg ai/ha two times" followed by the treatment "seedling root dip + Ekalux 25 EC @ 0.5 kg ai/ha three times". The heighest yield was obtained in "seedling root dip + Ekalux treatment". During the second crop season, "seedling root dip + Furadan 3 G application three times", was the best to control stem borer and gall midge. Other pests were not observed in the field during the season. As regards grain yield, "maximum protection" was superior, followed by "seedling root dip + Furadan treatment." Even though "maximum protection" and "application of granules" appeared to be best in controlling rice pests, "seedling root dip + Nuvacron as spray four times" will be the best economic treatment.

*Use of insecticides as granules for protection of rice crop against pests (Vellayani)*

The relative efficacy of different insecticide granules in Controlling different pests of paddy with reference to dosage, frequency of application, occasion of application and residues were assessed. Carbofuran, Phorate and Mephosfolan gave effective control of BPH, green leaf hopper, whorl maggot, stem borer, leaf roller, caseworm, grass hoppers and rice swarming caterpillar, Gall midge control was effective only at higher dose of Carbofuran. The mirid and spider population were reduced by Carbofuran application, whereas it was not affected by Mephosfolan and Disulfotol.

*Insect pest control trial (Pattambi)*

This was a trial to evaluate the effectiveness of selected spray formulations at lower doses against leaf roller and their effect on natural enemies. The trial was conducted with 15 treatments during first and second crop seasons. Ficom 80 WP @ 0.35 kg ai/ha was the most effective chemical against leaf folder, stem borer and gall midge. The number of predators and parasites was lowest in "maximum protection" treatment and Ficom treated plots. This was probably due to the negligible attack of leaf folder in these treatments. Ficom was better in controlling the stem borer and gall midge during second crop also. Coroban 20 EC @ 0.35 kg ai/ha was superior to other chemicals in controlling leaf folder. The highest yield during the first crop was in Somicidin treated plots and during the second crop season in "maximum protection" followed by SAN-155 treated plots.

*New insecticide trial II-sprays (Pattambi)*

The effectiveness of new insecticidal sprays against paddy pest complex was assessed. Ripcord @ 0.4kg ai/ha as spray gave better control of stem borer and leaf folder. The treatment recorded the highest yield of 6262 kg/ha during the first crop. In the second crop season, Malathion and Hildan reduced the stem borer and gall midge incidence. Against leaf folder, all the three were effective.

*Studies on the waiting periods of insecticides recommended for paddy pest control (Vellayani)*

The project aimed at fixing the waiting periods of insecticides recommended for paddy pest control and to reduce the toxic hazards by applying at suitable occasions. A field experiment was laid out during punja season of 1980-81.

*Effect of synthetic pyrethroids on the pests of paddy (Vellayani)*

The project aimed at studying the efficacy of four synthetic pyrethroids in controlling the pests of paddy in comparison with the insecticides now recommended. Results of the pot culture experiment revealed that these synthetic pyrethroids are not effective against BPH when compared to Carbaryl which was used as check.

### *Combined application of 2, 4-D and insecticides (Moncompu)*

The results of the trial conducted during the additional crop and punja at 1980-81 showed that there was no visible plant damage due to the mixing of insecticides and 2,4-D. The weedicide effect was not reduced due to the addition of insecticides as indicated by the weight of weeds. The yield was not affected by the mixing. However, the insecticidal action could not be evaluated as the insect incidence was negligible.

### *Gallmidge biotype study (AICRIP, Pattambi)*

The trial was conducted to compare the resistance in selected gall midge resistant cultures and donors of different locations. Among the 10 centries tested, six were found tolerant to gall midge attack. Jaya was the most susceptible variety.

### *Investigations on the nuclear polyhedrosis of the rice swarming caterpillar, Spodoptera mauritia (Boisduval) (Vellayani)*

Histopathological studies revealed that fat body, hypodermis and tracheal matrix cells were the principal sites of multiplication of the NPV of *S. mauritia*. The transmission of the virus was transevarial. The half life of the virus was found to be 90.12 hrs when subjected to weathering on paddy foliage, 101.6 hrs when heated at 35°C, 75.34 hrs under infrared rays and 57.72 hrs under UV rays. The virus was found to have a long persistence in soil. The half life of the virus in soil was estimated to be 6.46 months. The virus was found to have a long shelf life when stored at 4°C.

### *Population dynamics of different species of rats attacking paddy in Kuttanad (Moncompu)*

Trapping of rats with 60 traps were made every month. Observations during the year indicated that the peak population was in the month of June.

### *Bait preference of different species of rats attacking paddy (Moncompu)*

It was observed that rats prefer lime shell flesh among the bait bare traps. The order of preference was plantain fruits, coconut kernels, dried prawn, tapioca chips, broken rice and broken wheat.

## **COCONUT, ARECANUT AND OILPALM**

### **COCONUT**

#### **CONCLUDED PROJECTS**

##### **Crop management**

#### *Effect of NPK levels and frequency of application on the yield and bearing habit of T x D palms Pilicode)*

The object of this experiment is to assess whether the yield potential of T x D can be increased and the alternate bearing tendency reduced by heavy doses of split application of fertilizers. Two levels of

fertilizers (N-1000, P-640, K-2400g and N-500, p-320, K-1200g per tree) were compared. Application of higher levels of fertilizers marginally increased the yields; but did not commensurate the increased cost of inputs. This is in conformity with the previous years' results.

#### **Plant protection**

##### *Chemical control of cockchafer beetle (Pilicode)*

Object of the experiment is to find out an effective and cheap chemical for the control of cockchafer grubs infesting coconut garden. Preliminary trials have indicated that application of Chlordane 10% at the rate of 60 kg/ha is effective in the control of cockchafer.

##### *Studies on sex ratio regulation in Bracon brevicornis (KADP, Vellanikkara)*

The study revealed that a higher number of progenies were produced when heavier larvae (30-35 mg body weight) were exposed for parasitism at TH<sub>1</sub> combination and with lighter larvae (8-10 mg body weight) at TH<sub>3</sub> level. Thus oviposition of *B. brevicornis* varied with preferred levels of TH combinations and body weight of host larvae. A sex ratio of 1:3 (female: male, produced significantly better proportion of females at TH<sub>2</sub> TH<sub>3</sub> combinations.

#### **ONGOING PROJECTS**

##### **Crop improvement**

##### *Studies on coconut germplasm (Vellanikkara)*

The project was started in the year 1976 to find out the high yielding cultivars of coconut suitable for large scale cultivation in Kerala. Twenty two hybrids and twelve cultivars were maintained. Characters such as number of leaves produced per year, height of the palm, etc. were recorded.

##### *Varietal trial on coconut (Vellanikkara)*

The trial was laid out in 1976 to compare the performance of three popular hybrid varieties (Tall x Yellow Dwarf, Tall x Gangabondam Laccadive Ordinary x Gangabondam) and four *inter se* crosses (Cochin China x Cochin China, New guinea x New guinea, Philippines x Philippines and Java x Java) with two popular tall varieties (west Coast Tall and Laccadive Ordinary). Growth characters were recorded at half yearly intervals.

##### *Utilisation of existing germplasm and description of varieties (AICC & AIP, Pilicode)*

The objectives were the evaluation of exotic and indigenous cultivars of coconut and description of morphological characters of these cultivars. Replicated trials with promising types are also envisaged. The trial is in progress.



### *Genetic divergence in coconut (Vellanikkara)*

Work has been initiated to assess the genetic divergence available in the coconut germplasm of the Regional Research Station, Pilicode. Selection of five palms each of uniform age in 30 varieties of tall groups has been done. Observation on growth parameters, flowering and yield characters as well as copra, oil etc. are to be made for detailed genetic analysis.

### *Evolving varieties which are high yielding and resistant/tolerant to major pests and diseases (KADP, Vellanikkara)*

Eleven hybrids have been planted under the trial. The experiment was laid out in RBD with five replications. The initial growth measurements have been recorded.

### *Growth performance and disease resistance of coconut hybrids and cultivars [Vyttila]*

Nine hybrid combinations were selected for the study. Observations were made for the growth parameters and incidence of pests and diseases. Among the entries, TxD showed better vigour, growth rate and pest/disease tolerance.

### *Trial of promising seed materials [AICC & AIP, Pilicode]*

The objectives of the trials started in 1976 are to conduct field studies to isolate superior types & hybrids and to compare the performance of promising exotic types with West Coast Tall. Observations on the morphological characters were recorded.

### *Assessment of combining ability of coconut (KADP, Vellanikkara)*

The project aimed at the selection of dwarf coconut palms having high general and specific combining ability. Sixteen West Coast Tall palms have been selected at the Coconut Research Station, Pilicode and bunches in each palm pollinated with pollen collected from different dwarf palms. The nuts obtained from each combination have been collected and sown separately.

### *Evaluation of tall x different dwarfs (Nileswar)*

The trial was started in 1972. The objective of the experiment is to study the comparative performance of Tall x Dwarf, Dwarf x Tall and West Coast Tall. Early and better flowering was noted in West Coast Tall x GB. The trial is in progress.

### *Production of new cross combinations (AICC & AIP, Pilicode)*

Production and exchange of new crosses between the Co-ordination centres are envisaged in the project. The Centre produced W. C. T. x L. D., W. C. T x C. D. O, W. C. T. x G and W. C. T x M. D. Y. The intention is to isolate the most compatible and productive hybrids.

*Exploitation of hybrid vigour (AICC & AIP, (Pillicode)*

The trial was started in 1973 with a view to study the performance of different hybrids involving 15 parental combinations of Tall x Dwarf and to compare them with the West Coast Tall to elucidate the extent of heterosis and precocity in different combinations. The minimum flowering duration (56 months) was recorded by West Coast Tall x Laccadive Dwarf, followed by West Coast Tall x Choughat Dwarf Green (56.8 months). Maximum duration was for West Coast Tall (81 months). Palms have not attained steady bearing stage.

*Fixing up criteria for selection of hybrid coconut seedlings in nursery stage (KADP, Vellanikkara)*

The project was started in 1978-79. Three hundred and eighty nine West Coast Tall x Choughat Dwarf Orange and 357 West Coast Tall x Gangabondam hybrids were planted after detailed nursery studies. Growth measurements have been recorded.

*Studies of cross progenies of exotic tall varieties x indigenous varieties of coconut (Nileswar)*

The experiment was started in 1967 with 21 treatments and six palms in each treatment. All the palms have flowered only in six combinations. The least flowering was in Java type. Palms have not attained steady bearing. Higher rate of leaf production was noticed in Java x Tall, Laccadive Small x Dwarf, Tall x Java and Java.

*Variability studies in the seedlings progenies of Tall x Dwarf coconut hybrids (Vellanikkara)*

The project has been initiated to conduct nursery studies of open pollinated  $F_2$  progenies using the parameters already fixed for correlating seedling characters with adult palm yield and to find the possibilities of utilising open pollinated seednuts of T x D for further multiplication.

*Progeny studies in West Coast Tall palms of different yield groups (Balaramapuram)*

Mother palms of West Coast Tall were chosen and classed in to high (av. yield 120 nuts/year), medium (av. yield 80-120 nuts/year) and low (av. yield <80 nuts/year) based on the yield data of three successive years. Nut characters and data on the mother palm attributes are being collected. The trend showed that there exist variability in respect of all characters and the extent of variability varies from character to character

*Progeny row trial (Balaramapuram)*

The objective was to make comparison in performance and yield between progenies of T x D and T x GB. Five seedlings each of the two combinations were selected for the study. Uniform treatments were given for all the plants.

*Progeny studies in selected coconut palms of W. C. T. and Komadan (Vellayani)*

The project has been formulated with a view to carry out progeny analysis in the following three different populations of coconut palms.

West Coast Tali population at the Coconut Research Station, Balaramapuram.

West Coast Tall population at the Instructional Farm Vellayani and

Komadan population at the Instructional Farm, Vellayani.

*Evaluation of super mother palms of coconut by seedling progeny analysis (Vellayani)*

Ten super palms (yielding more than 300 nuts/year) were located in Trivandrum and Quilon districts. Data on mother palms are being collected. Seednuts have been collected from super palms and normal palms in the area. Prepotency of the mother palms will be studied based on progeny analysis.

*Study of prepotency in West Coast Tall (Nileswar)*

The project was started in 1961 with an intention of identifying pre-potent palms for seed nut collection and working out the standards for selection of such prepotent parents and the progenies. As in the previous years, tree number 30 36,78,19,54 and 30 recorded the maximum yield. While palms at Kuttiyadi gave yields more than 100 nuts/year, the progenies at Nileswar yielded only less than 20 nuts. The studies are in progress.

*Identification of prepotent mother palms in coconut variety Komadan (Vellayani)*

Mother palms were selected and classified as high (av. yield > 120 nuts/year) and low (< 80 nuts/year) yielders. Mother palm attributes and nut characters were recorded. The trend of the observations made so far suggested that there exist individual variation in respect of all characters and the magnitude of variability differed from variable to variable. Seedling characters will be studied in future to mark out the prepotent palms.

*Determination of prepotency of hybrid coconuts to produce high yielding progenies (Vellanikkara, KADP)*

Open pollinated seed nuts from 30 T x D palms in six parental combinations have been collected and sown in the nursery every month, from January 1979 to June 1979, after studying the nut characters. Germination data and growth measurements were recorded.

*Study of second generation selfed and sibmatic progenies (Pilicode)*

Objective was to evolve inbred lines in coconut and to find out whether hybrid vigour was available in the cross between first generation selfs. The sibmated progenies of all parents, except 1/1096 slowed

increased yield over selfed progenies. 1/109 and 1/74 recorded maximum yields among selfed progenies and sibmated progenies, respectively.

#### *Study of off types of different dwarf varieties (Pilicode)*

The trial was started in 1973. Off type seedlings of six dwarfs selected from the nursery were included in the experiment. The plants have just started bearing and have not attained steady bearing.

#### **Crop management**

##### *Management practices in reclaimed coconut garden (Kayamkulam)*

The intention was to evolve suitable package of management practices for coconut in the newly reclaimed sandy area. The treatment NPK @ 0.50:0.32:1.20+ 25 kg FYM/palm/ annum gave the maximum yield.

##### *Spacing cum manurial trial (Balaramapuram)*

The trial commenced in 1964 with an objective to study the effect of different levels of spacing and fertilizer on the growth and productivity of coconut. All possible combinations of three levels of spacing (5m<sup>2</sup>, 7, 5m<sup>2</sup> and 10m<sup>2</sup>) and three levels of fertilizer (N-0,340,680, P-0 225,450 and K-0,450,900 g/ tree/yr) were tried. Unlike in the previous years, the lowest spacing recorded slightly more yield than the intermediary one. Highest level of fertilizer gave the maximum yield in all the years. A progressive increase in the yield/palm was noticed this year also with the increase in the levels of both spacing and fertilizer.

##### *Nutrition cum water requirement studies on T x D coconuts (Pattambi)*

An experiment was laid out to examine whether the yield potential of T x D can be increased by applying different levels of fertilizers under irrigation levels.

##### *Fertilizer-cum-water requirement trial on Tall x Gangabondam hybrids (AICC & AIP, Nileswar)*

The trial was started in 1980 with three levels each of irrigation and fertilizer in split plot design. The seedlings have only just established.

##### *Response of irrigation water use efficiency and cost benefit ratio under limited and ample supply of water (KADP/Pattambi)*

This has been initiated as a nutritional cum water requirement trial with three levels each of irrigation and fertilizer in split plot design.

##### *Simple fertilizer trial in cultivators' field (Kayamkulam)*

The objective is to fix an economic level of fertilizer required for coconut under rainfed and irrigated conditions in different soil types. Results of the past three years showed that, higher dose of manuring (cultivators' practice + NPK @ 0.50:0.32:1.20+ 25 kg cattle manure/

tree) gave increased yield upto 32%. Trial will be continued for confirmatory results.

*Simple fertilizer trial in cultivators' field (Balaramapuram)*

The trial started in 1976 with three treatments. The yield trends indicated that cultivators' practice (25 kg/FYM+10 kg ash/tree/year) +NPK@ 0.50:0.34:1 20 kg/tree gave remarkably enhanced yield (36% more) when compared to the local practice. The trial will be continued.

*Simple fertilizer experiment in cultivators field (Kumarakom)*

Applications of NPK at 0.34, 0.17, 0.68 kg/ palm/year+ 25 kg FYM increased the yield of nuts. But the production of female flowers was higher in palms treated with NPK 0.50, 0.32, 1.20 kg/palm+25kg F. Y. M.

*Simple fertilizer trials in cultivators' fields (Pilicode)*

The trial was started in 1976 in 16 cultivators' fields at Pilicode and Nilaswar. Compared to the pretreatment yield, 35.5% more yield was recorded with cultivators' practice + NPK @ 0.50, 0.32, 1.20 kg/palm/year at Pilicode. The same trend was observed at Nilaswar also.

*Nutritional studies in coconut II-Simple fertilizer trial in cultivators' field under different soils types in irrigated and rainfed conditions (KADP, Vellanikkara)*

Two gardens in Calicut district were selected for the trial. In addition to 50 kg green leaves, each level of fertilizer treatments have been given to a group of twenty trees. Both control and treated plots were irrigated. The trial is in progress.

*NPK fertilizer trial starting from young seedlings (Balaramapuram)*

The trial is intended to study the response of palms from seedling stage to application of NPK at different levels. All possible combination of three levels were tried. The same trend was shown by the palms for the last two years. Highest yield was recorded for palms supplied with higher levels of fertilizer (NPK 0.68 : 0.45 & 0.90 kg/palm/year).

*NPK fertilizer trials in laterite soil types (Pilicode)*

The trial was started in 1976 with an objective of fixing the optimal dose of NPK for W. C. T. coconut in laterite soils under rainfed conditions. The growth indicated that plants receiving NPK @ 0.50, 0.50 & 1.25 kg/palm/year were superior to others. Plants are in their prebearing period.

*Tissue testing with a view to detecting nutrient deficiencies in agricultural and horticultural crops (3) - Foliar diagnosis and yield of coconut in relation to N, P & K (Vellanikkara)*

The objective of the trial is to develop foliar diagnosis technique in coconut with a view to predict nutrient deficiencies and yield in

relation to N, P & K and to study the uptake and distribution pattern of N, P & K in relation to varying soil fertility gradients. Sampling has been completed and chemical analysis started. Total number of leaves retained by palms was found to highly correlated with stabilized yield.

*Effect of micronutrients on the disease intensity in root (wilt) effected palms (Vellanikkara)*

The intention is to standardise micronutrient requirement of diseased palms in relation to yield and disease intensity. Lay out has been completed and the field experiment is in progress.

*Effect of sodium chloride with and without potassic fertilizers on growth and yield of coconut grown on laterite soils (Vellanikkara)*

The experiment was started in 1976. The plants receiving sodium chloride performed better than the control (plants receiving neither sodium chloride nor  $K_2O$ ) and the plants receiving  $K_2O$  alone. Complete replacement of  $K_2O$  with NaCl was found to be undesirable.

*Common salt as a substitute for potash in the nutrition of adult coconut palms (Pilicode)*

Bearing coconut palms were utilised to find out effect of common salt on their yield. An increased yield (over the pretreatment yield) was obtained from those receiving 750 g  $Na_2O$  + 250 g  $K_2O$ . Complete replacement  $K_2O$  with  $Na_2O$  was found to be undesirable.

*Response of D x T hybrids to common salt application from young stage onwards (Pilicode)*

The intention is to find whether application of common salt influences the performance of coconut palms and also to find whether common salt can act as a substitute for potassium in the nutrition of coconut. Palms receiving 250 g  $Na_2O$  + 750 g  $K_2O$  ranked first in respect of vegetative growth. The trial is in progress.

*Effect of boron on the leaf rot disease of coconut (Vellanikkara)*

The objective is to study whether the leaf rot disease of coconut can be controlled or prevented by the application of boron. Trial is in progress.

*Nutritional studies on coconut—The effect of micronutrients on yield and disease resistance In cocnut (KADP, Vellanikkara)*

The experiment is undertaken on the existing Laccadive Ordinary palms. Zinc sulphate, ammonium molybdate and borax were applied at three levels with and without organic matter, in addition to uniform dose of N, P and K. Soil and leaf analysis were in progress.

*Effect of selected chemicals on the expression of root (wilt) disease (Vellanikkara)*

The objective is to screen and identify chemicals which can suppress or control the root disease. A large number of chemical agents

under the category of hormones, phenolics, glycosides, oxidising and reducing agents etc will be screened by studying the effect of their application on diseased palms. Trial is in progress.

*Effect of chemicals and planofix (N A A) on the setting of nuts in coconut (Vellayani)*

After collecting harvest data, 50 palms were selected for the treatments. The trial was started in 1979. Harvest data is being collected regularly.

*Studies on the suitability of annuals as intercrops in coconut gardens in relation to its economics (Kumarakom)*

Elephant foot yam, colocasia, ginger, turmeric and tapioca were tried. The net return from an area of 12 m<sup>2</sup> in the case of turmeric was Rs. 38.75 and Rs. 30.05 for tapioca, the other crops being less economic.

*Trial cultivation of banana as an intercrop in coconut garden (Kumarakom)*

The study is aimed at finding out the best variety of banana suited under the bund system of coconut gardens. Varieties 'palayanthodan' 'monthan' and 'padatty' have been found to be best suited. A replicated trial with the above three varieties along with 'nendran' is proposed during 1981-82.

*Trial cultivation of fodder varieties as an intercrop in coconut garden (Kumarakom)*

Studies to screen out the best variety of fodder grass revealed that hybrid napier, guinea grass, setaria and para grass yielded 165, 120, 94 and 95 tonnes/ha, respectively showing that hybrid napier is the best suited.

*Intercropping trials of tree spices and cocoa in coconut garden under the bund system (Kumarakom)*

Performance of tree spices like nutmeg, clove, cinnamon and cocoa is being studied under mixed cropping system in coconut garden. The crops are in the early stage of growth.

*Pepper varieties in multistoreyed cropping system (Piliode)*

This project is aimed at finding out the most suitable pepper variety in the multi-storeyed cropping programme in coconut gardens. Panniyur-1, Karimunda, Balankotta, Kalluvally, Kottanadan and Narayakodi were tried in the experiments. Panniyur-1 recorded maximum yield this year, followed by Karimunda and Balankotta. This is in conformity with the previous year's results.

*Effect of raising cocoa as an intercrop in adult coconut plantation (AICC & AIP, Piliode)*

The object of the experiment is to find out the effect of raising cocoa as an intercrop on the yield and bearing habit of coconut and

to study the performance of cocoa in different systems of planting. Slight reduction in the yield of coconut interplanted with cocoa was noticed during the year. Previous year's results did not show any adverse effect on coconut. The performance is being watched further.

*Studies on the influence of raising cocoa as an intercrop in coconut garden on the chemical and microbiological characteristics of laterite soil (Pilicode)*

The object is to find out the influence of raising cocoa as an intercrop in coconut garden on the chemical and microbiological characteristics of laterite soil. The experiment was started in 1980.

*Effect of leaf cutting on the productivity of coconut palms (Pilicode)*

The experiment was started in 1977 with a view to find out the effect of removing certain number of leaves on the productivity of palms. A declining trend in nut yield was noticed during the year in all the treatments compared to the pre-treatment yield. The experiment will be continued for one more year.

*Effect of tapping on the yield of coconut palms under irrigated and un-irrigated conditions (Nileswhwar)*

Influence of tapping on the yield of coconut palm was studied in this experiment. The trees were tapped for two years in 1977 & 1978 and left to study their yield performance. There was no yield in any of the palms in the trial during 1979 and 1980. The trees will be observed for one more year and the trial will be concluded.

**Plant protection**

*Studies on resistance of selected varieties to pests & diseases (KADP, Kumarakom)*

Studies on the incidence of pests and diseases on selected hybrids revealed mild attack of mealy bug and rhinoceros beetle in the crosses CDO x LO, CDG x Phil and CDG x SRM.

*Disease resistance trial on coconut (Kumarakom)*

The relative tolerance/resistance exhibited by a few varieties under field condition was studied during the year. The varieties studied were SS Green, Malayan Dwarf, Cochin China, Andaman Giant, Andaman Ordinary, along with D x T hybrid and WCT. All the entries were susceptible; but Andaman Ordinary was less susceptible.

*Disease resistance trial of coconut hybrids (Kumarakom)*

Sixteen hybrid crosses of different coconut varieties were evaluated under field conditions for resistance to root wilt and leafrot. All the test materials exhibited varying intensities of root (wilt) disease, the least being recorded in AD x YD.

*Disease resistance trial on coconut (Kumarakom)*

Twenty two hybrids of different parentage were field evaluated for resistance to root wilt and leaf rot disease. All the hybrids were



susceptible to root wilt and leaf rot exhibiting varying degrees of disease symptoms. Hybrids T x SS and Phil x Phil exhibited lowest degree of disease symptoms.

*Disease resistance trial on hybrids, Dwarf Orange x Tall Green and Dwarf Green x Tall (Kumaraom)*

Hybrid seedlings of Dwarf Orange x Tall Green and Dwarf Green x Tall planted in the field were evaluated for root wilt incidence using the standard scoring system. Root (wilt) disease index was lowest in DO x TG hybrids.

*Disease resistance trial on coconut (Kumarakom)*

Thirty six hybrid progenies from five family groups planted in the field were studied for root (wilt) disease incidence. All the hybrid progenies showed root (wilt) disease symptom. The lowest intensity (34.23) was exhibited by Laccadive Ordinary and Cochin China.

*Disease resistance trial on coconut (Kamarakom)*

Six hybrids were evaluated for root (wilt) disease incidence. All the hybrids were susceptible, the intensity ranging from 24.78 in T x D to 28.99 in T x T.

*Disease resistance trial on coconut (Kumarakom)*

Progenies of eight crosses were evaluated for resistance to root (wilt) disease. All the hybrids were susceptible to the disease, the intensity ranging from 18.65 in Java x LD to 52.3 in NG x LD.

*Disease resistance trial on seedlings from apparently healthy WCT mother palms (Kumarakom)*

Seventy one progenies from six apparently healthy WCT mother palms planted in the field were studied for disease incidence. Excepting 18 seedlings, all others exhibited symptoms of root wilt ranging from 10.77 to 25.79.

*Study of the intensity of various diseases affecting coconut and assessing the loss in yield due to diseases (Kumrakom)*

The intensity of various diseases affecting coconut palms like root wilt, leaf rot, bud rot, stem bleeding etc. were estimated using the standard scoring systems. A decrease in the intensity of root wilt and an increase in the incidence of stem bleeding were observed.

*Control of grey leaf blight disease of coconut caused by Pestalotia palmarum by using newer fungicides (Balaramapuram)*

The trial was started in 1979. Out of the five fungicides tried, no significant difference was noted between treatments. Bordeaux mixture was found to be the most effective fungicide.

*Etiology and ecological studies on grey blight disease (Balaramapuram)*

The objective is to correlate between the agroclimatic factors and the incidence of the disease so as to give an indication to the agroclimatic factors which are congenial for the out break of the disease. The trial is in progress.

*Studies on the stem bleeding disease of coconut (Pilicode)*

The object is to find out the causes and control measures of stem bleeding disease of coconut. Observations made so far indicated that the disease symptoms appear on trees above 13 years of age. High yielding trees were more susceptible to the disease in laterite soils. Necrotic areas appeared on roots and the root re-generation capacity was lost. Investigations on the control aspect of the disease is in progress.

*Biochemical characterisation of root (wilt) disease (Vellanikkara)*

Extracts of leaf and root samples collected from the root (wilt) affected palms at Irinjalakuda were subject to uv and visible spectrophotometry for identifying possible differences in the spectrum between the healthy and diseased palms.

*Physiological basis of degeneration in the root (wilt) affected coconut palms (Vellanikkara)*

Five palms each have been selected at Vellayani, Kayamkulam and Kumarakom. Observations are being taken.

*Integrated control of root (wilt) disease from seedling stage (Kumarakom)*

The project is aimed at evolving suitable control measures for the root (wilt) disease by giving protection from seedling stage.

Nutrients like Ca, Mg and Zn, Dasanit—a nematicide, Benlate—a systemic fungicide and Agrimycin—a bactericide were applied in different combinations along with a basal application of NPK at the recommended dose. Observations during the year revealed that there was a general decrease in the intensity of root (wilt) disease in all the treatments during the year,

*Integrated control on root (wilt) affected young palms (Kumarakom)*

Nutrients like Ca, Mg and Zn, the nematicide—Dasnit, the systemic fungicide—Benlate, and the bactericide—Agrimycin were applied in different combinations over basal application of the recommended dose of NPK. The intensity of root (wilt) was low in palms applied with Ca & Mg, while it was highest in untreated control.

*Effect of soil insecticides on the pupating grubs of rhinoceros beetle (Vellayani)*

An experiment was laid out to study the pre-estant toxicity of BHC and Heptachlor at two doses on the pupating grubs of the rhinoceros beetle.

***Studies on residual toxicity of systemic insecticides injected to coconut palms (Vellayani)***

The objective of this project is to study the bio-efficiency of insecticides, injected in to the trunk, on the black headed caterpillar and to find out the residues that may occur in coconut meat and water. Monocrotophos, Phosphamidon and Dimethoate were tried and it was seen that trunk injection of these insecticides can give good control of black headed caterpillar.

***Chemical control of the red palm weevil using stem injection technique (Kumarakom)***

Systemic insecticides like Monocrotophos, phosphamidon, Dimethoate and Methy demeton were tried by stem injection method on the control of palm weevil grubs. Observations on the recovery of affected palms revealed that stem injection of Monocrotophos gave 84.6% recovery, followed by Phosphamidon (77.4%).

***Studies on sex ratio regulation on Bethylids (KADP, Vellanikkara)***

It was observed that 80% and 90% RH with three levels of temperature (25,27 and 29°C) were unfavourable for production of more female progenies.

***Studies on the temperature humidity tolerance of Bethylid parasite (KADP, Vellanikkara)***

Five levels of RH (50,60,70,80 and 90%) and three levels of temperature (25,27 and 29°C) tested revealed that 80% and 90% RH with all levels of temperature were unfavourable for the fecundity and progeny production of the insect parasite.

***Studies on corid bugs attacking coconuts***

The objectives of the trial are identification of the bugs, working out the biology, studying the nature of damage, searching for natural enemies and working out the control measures. The pest was identified as *Paradasynus rostratum*. Three egg parasites have been collected.

***Control of rodents infesting coconut garden (Kumarakom)***

To evolve suitable control measures for the rodents, two types of trials were conducted. In the first trial, four types of traps namely bow trap, Moncompu type, Kumarakom type and common rat trap were evaluated for finding out the best type of trap. The Kumarakom type was found to be the best. In the second trial, the relative preference of different food stuff was evaluated using Kumarakom type trap. Of the food stuff tried, coconut kernel, wheat bran and coconut cake were found to be cherished by rats.

## SPICES, COCOA & OTHER BEVERAGE CROPS

### PEPPER

#### CONCLUDED PROJECTS

##### Crop management

##### *Intercropping trial in pepper gardens (Panniyur)*

The trial was undertaken since 1977-78 to examine the feasibility of intercropping in pepper gardens and to identify the most suitable inter crop. Banana, Elephant foot yam, colocasia, ginger and turmeric were evaluated as intercrops. Intercropping with banana reduced the yield of pepper, probably due to shading effect. Turmeric showed beneficial effects on pepper. It is inferred from the data that elephant footyam, colocasia, ginger and turmeric are suitable intercrops for pepper gardens provided that the same crop is not grown year after year in the plot.

##### Plant protection

##### *Quick wilt disease of pepper—Symptomatological studies (KADP)*

The symptoms of the disease expressed in the various plant parts were described in detail. The first visible symptom noticed on leaves was water soaked region, 24 hrs after inoculation. This was followed by rotting. The lesion consisted of necrotic centre and plasio necrotic zone surrounded by a yellow halo. The symptom was more pronounced on the upper surface than on the lower surface. The immature leaves took infection more quickly. In the stem also, water soaked region similar to those on leaves appeared. The infected region appeared wet and slimy. Vascular discoloration was seen beyond the point of infection. The region below the infection remained healthy for a few days and then decayed. Death of the plant occurred 12-20 days after inoculation. In the case of roots, initial symptom was brownish discoloration of tip of fine roots, which gradually spread to other regions. The visible symptoms on aerial parts as a result of root infection were similar to those found in vine infection. As the disease progressed, flaccidity, drooping and defoliation of leaves were the marked symptoms.

Among the fungicides tried, Bordeaux mixture, Agallol, Bayer 5072 and Thiride were effective in completely checking the growth of fungus. All fungicides sprayed and drenched two hrs before inoculation completely checked the development of disease, indicating that prophylactic measures are necessary.

##### *Fungicidal trial for the control of quick wilt disease pepper (Panniyur)*

The trial was conducted for four years in a farmer's field at Alakode to determine the appropriate time and number of fungicidal application for effective control of the disease.

Inoculum potential in the soil around each plant was ascertained by the 'castor seed baiting technique'. The four-year data indicated that

one pre-monsoon pasting with 10% Bordeaux paste coupled with one foliar spray of 10% Bordeaux mixture is the minimum plant protection schedule for controlling the quick wilt of pepper. Taking into account the variation in intensity and distribution of rainfall from year to year, two (May-June and July-August) or three (May-June, July-August and September-October) sprayings are recommended along with the pre-monsoon pasting.

#### *Chemical control of nematodes infesting pepper vine (Vellayani)*

The effects of nematicidal control of root knot nematodes and burrowing nematodes on the slow wilt disease of pepper was studied. Though no conclusive inference could be arrived at from the data so far obtained, considerable decrease in the nematode population along with marked improvement in the growth of the vine was observed.

#### *Ecology and control of pepper pollen beetle, Longitarsus nigripennis, Chrysomelidae: Coleoptera (Vellayani)*

Studies on the distribution of *Longitarsus nigripennis* showed that the pest was distributed throughout Kerala. The damage caused by the pest to pepper berries ranged from 10 to 32 per cent. Positive and significant correlation was observed between rainfall and population density. Shade intensity also had a positive influence on the pest incidence. Arakkulam Murda was the most susceptible variety and Kalluvally, the least susceptible. Studies conducted to ascertain the effect of insecticide sprays on spike damage showed Methamidophos as the most effective insecticide. It was followed by Endosulfan, Methyl parathion, Monocrotophos Isfenphos, Quinalphos, Dimethoate and Methyl demeton. But Monocrotophos ranked first in controlling the adults of *L. nigripennis*. Insecticides like Endosulfan, Quinalphos, and Methyl parathion could safely be used on berries as those insecticides did not leave any toxic residue at the picking stage.

### ON-GOING PROJECTS

#### **Crop improvement**

##### *Germplasm collection and screening of pepper varieties (Panniyur)*

The collection of 107 cultivars and wild types were maintained. Twenty six new wild types from the Western Ghats and three cultivars were collected. As the roots of the original planting became old and senile, a phased replanting has been scheduled. Accordingly, 69 types were replanted during the year.

##### *Collection and maintenance of germplasm bank of Piper spp. (Pepper Research Scheme)*

Based on 1980-81 data, the following, five out of 49 collections which have commenced bearing were identified as promising.

*Average yield of green berries*

	kg/std.
Kotta (Col. No. 72)	4.278
Thevanmundi (Col. No. 84)	2.998
Kottanadan (Col. No. 44)	2.623
Naranyakodi (Col. No. 51)	2.511
Kuthiravally (Col. No. 32)	2.428

Collection No. 84 showed good berry yield, short internodal length, close berry setting, etc. during the previous year also.

*Hybridisation in pepper (Panniyur)*

The objective of the project is to evolve high yielding varieties of pepper with resistance to pests, diseases and adverse conditions. Among the hybrid and open pollinated seedlings planted, 104 progenies flowered during the year. Based on the yield, 31 cultures were provisionally selected. The 56 cultures selected in 1979-80 were put under progeny row for multiplication and evaluation. The selected cultures planted during 1978 commenced bearing. The culture No. 354 performed better than all others and the standard (1.629 kg/vine as against 0.499 kg and 0.866 kg for Panniyur-1 and Karimunda). Hybridisation involving 11 parental combinations was done during the year.

Cheriyakaniyakadan	x	Karimunda
Panniyur-1	x	Kumbhakodi
Panniyur-1	x	Cheriyakaniyakadan
Karimunda	x	Panniyur-1
Karimunda	x	Kuthiravally
Karimunda	x	<i>P. attenuatum</i>
Uthirankotta	x	Cheriyakaniyakadan
Uthirankotta	x	Karimunda
Kuthiravally	x	Karimunda
Kumbhakodi	x	Panniyur-1

The hybrid seeds and the open pollinated seeds collected, totalling to 18155, were sown during February-March, 1981.

*Screening of open-pollinated and hybrid seedlings for evolving a disease resistant and high yielding variety (Pepper Research Scheme)*

Among the eighty open pollinated and hybrid seedlings brought from Pepper Research Station, Panniyur and planted at Vellanikkara, the following were promising.

<i>Culture No.</i>	<i>yield of green berries (kg/vine)</i>
11	1.520
16	1.035
33	2.020
54	1.350
74	1.918
94	3.060

A rapid screening technique is being developed.

*Breeding varieties of pepper with desirable characters (KADP, Vellanikkara)*

822 open pollinated and hybrid seedlings coming under 84 accessions have been planted. Of these, six accessions have given more than one kg green pepper during 1st flowering season. Studies are in progress to evolve a rapid technique to screen large number of rooted cuttings against *Phytophthora*.

*Varietal trial on pepper (Pepper Research Scheme)*

Panniyur-1 is being compared with other important cultivated varieties of pepper during 1979-80. Kottanadan ranked first followed by Panniyur-1 and Narayakodi during the year under report. Although the trend was the same, the varieties did not show statistically significant differences with reference to green berry yield.

*Comparative yield trial of pepper varieties (Panniyur)*

In this trial also, Panniyur-1 is being compared with four popular varieties of pepper. The yield data of the previous year indicated the superiority of Panniyur-1. During 1980-81, due to peculiar weather conditions, there was a marked reduction in yield of all varieties. Kuthiravally performed better than Panniyur-1.

*Morphological studies on pepper varieties (Panniyur)*

Detailed studies on vegetative, sexual and yield characters of the established varieties in the germplasm collection was continued. Description of 27 varieties was completed during the year.

*Formulation of a key for identification of the different types of pepper, Piper nigrum L. (Vellanikkara)*

From the 50 varieties available in the germplasm collection, data on six vegetative and nine reproductive characters were recorded. Preparation of a key is underway.

*Growth, flowering, floral biology and spike shedding in pepper, Piper nigrum L. (Vellanikkara)*

Shoot growth in pepper was observed during four months of the year from May to August, with maximum in July and minimum in August. Flowering followed a pattern similar to growth.

The percentage of aborted spikes ranged from 0 to 26.3%. The spike development followed a linear pattern, attaining maximum length in 31.67 and 29.26 days in Panniyur-1 and Karimunda, respectively. The period of anthesis was 8.12 days in Panniyur-1 and 9.21 days in Karimunda. Anther dehiscence extended for 7.72 to 5.0 days. The protogyne stage lasted for 6.52 and 5.27 days in the two cultivars. Rainwater was found to be a major factor in pollination.

Pollen germination was maximum (95.97%) in a medium containing 4% sucrose, 20ppm boric acid and 10 ppm calcium nitrate.

Spike shedding which occurred during almost all the months from spike emergence to harvest was maximum in June and minimum in May. Eight stages of shedding could be observed with the maximum shed during the first month of fruit set.

#### *Flower bud differentiation in pepper (Vellanikkara)*

The project was taken up to find out where exactly (which node) the flower bud differentiation is taking place and the exact tissue at which flower bud differentiation is taking place.

### **Crop management**

#### *Training and pruning trial on pepper (KADP, Vellanikkara)*

The experiment on standardisation of pruning techniques in bearing pepper vines was laid out in the existing pepper garden at Vellanikkara. The treatments have been started in February 1981. Observations on shoot growth and flowering characters are being recorded. Another experiment on standardisation of training and pruning of young pepper vines was also laid out at Vellanikkara in the existing gardens. This experiment however had to be abandoned because of extreme drought conditions, resulting in loss of large number of vines. Fresh planting has to be done to start the experiment.

#### *Effect of pruning on growth, quantity and quality of produce in pepper, Piper nigrum (Vellanikkara)*

Since pepper bears on the axils of current season's growth, the project is mainly aimed at knowing whether new axillary growth could be produced by pruning and thereby the yield could be increased.

#### *Cultural trial on pepper (Pepper Research Scheme)*

The project aims at standardising the cultural operations required for pepper for economic production. During 1979-80, 'digging one metre around the plant and sickle weeding rest of the area once a year' gave higher yields than the other treatments. During the year under report, 'digging one metre around the plant and sickle weeding rest of the area twice a year' gave higher yields. However, the treatment differences were not statistically significant.



***Studies on the effect of mulching with different materials on the growth and yield of pepper (Panniyur)***

The experiment was started in 1977-78 on four-year old Panniyur-1 plants. Mulching the basins with different materials at the onset of summer increased the number of spikes as well as yield of green pepper. Sawdust seemed to be the most suitable mulching material. Moisture percentage in the soil during the summer months was maximum in basins mulched with dry leaves followed by those with sawdust. Weed growth was minimum in the basins mulched with plastic sheet.

***Studies on the influence of planting materials on the growth habit and yield of pepper vines (Panniyur)***

The influence of different types of planting materials (different stem portions) on the growth habit and yield of the resultant vines was studied. The two-year data indicated that the middle 1/3 portion and the top 1/3 portion of the runner shoots are the best planting materials.

***Trials with planofix and other plant hormones on pepper (Panniyur)***

Trials conducted during the past three years proved that dipping the cutting in a 1000 ppm solution of 3 IBA induce early root initiation, better development of roots and root production in general. During the year under report, IBA treatment as above was compared with treatment of the cuttings with Seradix -B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub> (a proprietary product marketed as a root inducing hormone). Five hundred cuttings each were treated. The data indicated that IBA treatment was superior to all other treatments in respect of earliness in root initiation, number of cuttings rooted, number of roots and weight of roots produced, shoot development and leaf production. This was followed by Seradix B<sub>1</sub>. In all aspects, Seradix B<sub>2</sub> had a depressing effect.

***Spacing-cum-standard-cum varietal trial on pepper (KADP, Vellankkara)***

A factorial experiment with 18 treatments and four replications has been laid out. The treatments include three types of standards, three spacings and 2 varieties (Panniyur-1 and Karimunda). Growth measurements recorded have shown maximum height and girth of vines, in vines grown on Teak wood standards followed by Erythrina and Garuga standards.

***Fertilizer-cum-standards trial on pepper (Pepper Research Scheme)***

Dead standards were found to be superior to live standards with regard to plant height, length of spikes, number of spikes and weight of spikes. Lowest level of K (75 g/vine/year) was superior to the highest level of K (225 g/vine/year) and the middle level (150 g/vine/year) was on par with others, with regard to the number of spikes. With referencé

to the average length of spike, the lowest level of N (75 g/vine/year) was found superior to the others. The middle level of P (50 g/vine/year) was superior to the other levels with regard to the green-pepper yield.

#### *Fertilizer trials on pepper variety-Karimunda (Pattambi)*

The experiment was laid out in a factorial design with three levels each of N, P and K to assess the yield potential of Karimunda pepper variety.

#### *NPK fertilizer trial on local varieties of pepper in cultivators' fields (Panniyur)*

Two different experiments are in progress since 1977-78 in cultivators' fields at Alakode. Three levels each of N (50, 100 & 150 g), P (25, 50 & 75 g) and K (100, 150 & 200 g) per plant per year are tried in a factorial confounded design with two replications. The fertilizers were applied in two split doses in June and August. Number of spikes and yield of green pepper per plant were recorded at the time of harvest. From the data so far obtained 50g of nitrogen, 75 g of phosphorus and 200g of potash per plant per year seemed to be the optimum dose. However, final conclusions can be drawn only after continuing the experiments for one or two years more and analysing the data statistically.

#### *NPK fertilizer trial on Panniyur-1 var of pepper (Panniyur)*

The experiment was started in 1975-76. Three levels each of N, P and K (50, 100 and 150 g per plant per year) are tried in the experiment (factorial confounded design with two replications). The data so far obtained indicated that a treatment combination of  $N_1$  (50 gN),  $P_2$  (100 g  $P_2O_5$ ) and  $K_3$  (150 g  $K_2O$ ) will be the optimum dose of fertilizers for Panniyur-1 variety of pepper.

#### *Investigations on the nutrition of black pepper, Piper nigrum L. (Vellanikkara)*

The project has been initiated to find out the critical level of nutrients in pepper.

#### *Micronutrient trials on pepper (KADP, Vellanikkara)*

A  $4^3$  factorial experiment with 64 treatments and eight replications using Panniyur-1 variety of pepper was laid out and planted in 1980. The micronutrients will be applied as soon as the plants attain sufficient growth.

#### *Standardisation of leaf analysis technique in pepper (KADP and Panniyur)*

The leaf samples have been collected from the NPK fertilizer trial at the Pepper Research Station, Panniyur at monthly intervals. The chemical analysis is in progress.

*Tissue testing with a view to detecting nutrient deficiencies in agricultural and horticultural crops (4): Foliar diagnosis-yield and quality of pepper in relation to N, P and K (Vellanikkara)*

Experimental plants from the standing NPK fertilizer trial available at the Pepper Research Station, Panniyur were selected for the study. The type of shoot, position of leaf and period of sampling will be standardised. Pattern of N,P,K uptake, response to NPK in terms of yield and quality of pepper etc. are to be studied. The chemical analysis of the samples is in progress. Sampling of soils, leaves, stem and berries of the experimental plants has been completed.

*investigations on spike shedding in pepper, Piper nigrum L. (Vellanikkara)*

The extent of spike shedding in Panniyur-1, Karimunda, Kottanadan was found to vary from 2 to 19 percent. Nutritional status of the plant, moisture stress, disease and climatic factors were found to have influence on spike shedding. The external application of growth regulators showed no influence on reducing the spike shedding.

#### **Plant protection**

*Role of nematodes on the incidence of slow wilt disease of pepper and to find suitable control measures (KADP,Vellanikkara)*

A experiment was laid out with seven treatments and ten replications at Vellanikkara. The treatments were: inoculation of plants with *Radopholus similis* at 500/plant (T<sub>1</sub>), 100/plant (T<sub>2</sub>), with *Meloidogyne incognita* at 500/plant (T<sub>3</sub>), 1000/plant (T<sub>4</sub>), mixed population of the above two 250 each/plant (T<sub>5</sub>) and 500 each/plant (T<sub>6</sub>). Uninoculated control (T<sub>0</sub>) was also included. Cement tube filled with sand and soil treated with formalin were used for planting. Treatments will be given once the plants attain vigorous growth.

In another experiment under this project, soil & leaf samples from diseased and healthy vines were collected from five gardens in Cannanore district. The samples were analysed for major and micro nutrients. The soils of the basins of healthy & diseased vines were similar in respect of pH, organic carbon, P & K. In general, soils were rich in organic matter and medium to high in available potassium. Leaf samples collected during April showed that foliar levels of N and K were below the critical level while those of Ca, Mg, S, Cu, Fe and Mn were adequate. However, diseased vines showed lower potassium levels as compared to the healthy vines.

*Slow wilt disease-Adoption of suitable cultural practices in addition to plant protection measures to rejuvenate slow wilt affected plants (KADP, Vellanikkara)*

Two field trials were laid out, one each in the slow wilt affected areas of Idukki and Calicut districts with five treatments and six replications. The treatments included cultivators' practices and KAU

recommendations. The chemical used was Aldicarb 1 g ai/vihe, two times in May-June and in September-October. The pre-treatment nematode population was assessed/100 ml of soil. Treatments were applied from October. The observations on nematode population and symptoms expressed will be taken from the second application of nematicides.

*Quick wilt disease of pepper-Survey of collateral hosts of Phytophthora palmivora, especially the weeds and other economic plants usually seen in pepper gardens of Kerala (KADP, Vellanikkara)*

The work on the survey of collateral hosts of the organism has been started. Two pepper gardens from three districts viz. Cannanore, Calicut and Trichur have been selected for the survey work. The first survey was conducted at the Pepper Research Scheme, Vellanikkara and the CPCRI station, Kannara. The collected specimens were brought to the laboratory and isolation carried out. So far, *Phytophthora* was isolated from arecanut and colocasia.

*Quick wilt disease of pepper-Ecological studies (KADP, Vellanikkara)*

Plots have been selected and the plants have been marked during the year.

*Ecological studies on quick wilt disease pepper (Pannivur)*

There is an isolated plot at the Pepper Research Station where the disease has been appearing continuously for the last few years. In this plot observations were taken at weekly intervals on the incidence of the disease. Soil temperature at the depth of 5 cm, 15cm and 30cm, minimum and maximum temperatures were recorded daily. Other weather parameters were also recorded regularly. It has been found that the disease was more prevalent during the month of July-August i.e. during South West monsoon when the temperature was low and R. H. was high. A combination of low atmospheric temperature (near about 20°C) and high relative humidity seems to favour the appearance of the disease in the field. Water logging conditions in the soil too favours the disease incidence.

*Quick wilt disease of pepper-II. The techniques for screening pepper varieties against quick wilt disease caused by Phytophthora palmivora (Butler) (Vellanikkara)*

The objective was to develop a rapid and perfect technique to screen a large number of varieties (both open pollinated and hybrid seedlings) against the quick wilt organism of pepper.

Different media were tested to determine the best medium for getting more microbial metabolite in the culture filtrate.

The plants were inoculated with potential inoculum, mycelium and sporangia and also with fungal-free culture filtrate. The symptom development in both cases were compared.

When the cut-ends of pepper vine branches were dipped in the culture filtrate and in the zoospore suspension (for 24 hrs, 48 hrs and 72 hrs), the discoloration of the vascular bundles was observed. The experiment is in progress.

*Studies on fungal pollu-Etiology of anthracnose disease of pepper-nature and extent of damage (KADP, Vellanikkara)*

Fifty standards were randomly marked for assessing the disease incidence. The pathogens were isolated from the diseased parts of vines and confirmed as *Colletotrichum gleosporioides*. From the harvested spikes, the percentage thread and berry infections were calculated. The loss in weight as a result of infection was also worked out.

*Study on the etiology and ecology of fungal pollu in pepper (Panniyur)*

The main object of the project is to ascertain the correct time and stage at which the infection by fungus occurs, so as to determine the proper time of application of fungicides against the disease. It was found that percentage of infection was more on the eastern side at two meter height. However, infection was low on eastern side at 3 meter height. Total infection was less on southern side. It has been observed that spike shedding was more due to other factors than due to fungal infection. Out of total shedding of 21.55%, shedding due to fungal infection was only 9.54. It was also seen that percentage of loss of weight was more (67%) when berries were infected early. Loss of weight was very high (75%) due to thread infection. The fungus (*Colletotrichum gleosporioides*) was more pronounced during August-September.

*Studies on the ecology and etiology of fungal pollu (Vellanikkara)*

The objective was to find out correlation between climatic parameters and the incidence of fungal pollu in pepper and to find out the critical time of infection for adopting effective control measures.

It was observed that the pathogen *Colletotrichum gleosporioides* attacks different parts of the vine viz. leaves, spikes, berries, tender shoots etc. Maximum leaf infection occurred during the second fortnight of July in 1979. Maximum berry infection was found during the first fortnight of October and first fortnight of November in 1979. Maximum shoot infection was noticed during the second fortnight of October, 1979.

*Field trial for the control of fungal 'pollu' (Panniyur)*

From the previous year's experiment, it has been found that the efficacy of Bavistin and Bordeaux mixture is almost on par in controlling fungal pollu'. By considering the cost of Bavistin, it was decided to continue the experiment with Bordeaux mixture. It was found that the infection was minimum when Bordeaux mixture was sprayed in last week of June, first week of July and third week of September.

*The effect of prophylactic control measures of quick wilt (stem rot) disease on the control of fungal pollu (anthracnose) of pepper (KADP, Vellanikkara)*

The experiment was laid out in RBD with four treatments and five replications. The treatments are: T1—quick wilt control measures as per package of practices, T2—spraying of Dithane Z-78 (0.2%) once in June–August and again in September–October, T3—treatments 1+2, T4—control. From the tagged leaves, the number and size of the disease spots were observed according to a standard scale of infection, based on total percentage infection of spikes during 80-81. T3 was found to be effective and on par with T1. Based on berry infection, T1 rated first which was on par with T3 and they were significantly superior to T4 and T2.

*Bacterial leaf spot of pepper (Piper nigrum L.) incited by Xanthomonas betlicola Patel et al. (Vellayani)*

The main objective of the project was to conduct detailed investigations on the etiology and symptomatology of the disease, host range studies and screening pepper varieties for source of resistance and studies on chemical control of the disease. Nine different isolates have been examined and their pathogenicity was proved. Cuttings of local pepper varieties were collected and screened against the disease.

*Studies on the microflora of stored pepper (Vellanikkara)*

The object of the study is to find out the microflora associated with stored pepper and the effect of these organisms on the deterioration of quality of pepper.

Graded pepper (garbled, ungarbled and pin head pepper) was collected from export traders and the microflora associated with stored pepper were isolated and studied.

The microbial study from the stored pepper revealed that four genera of fungi namely *Aspergillus spp.*, *Curvularia sp.*, *Fusarium sp.* and *Penicillium sp.* are constantly associated. Apart from this, one species of bacterium was also found associated with the stored pepper. The effect of storage of pepper in different humidity and temperature levels, after inoculating the above micro organisms, was also studied to find out the quality and quantity deterioration of the inoculated stored pepper.

Reduction in weight, status of total carbohydrates, starch, soluble sugar, oleoresin and piperine content of stored pepper were also estimated.

## CARDAMOM

### CONCLUDED PROJECTS

*Study on the initiation of flowering by hormonal treatment in selected cardamom varieties grown in coconut gardens (Vellayani)*

Survival of cardamom seedlings as well as clones was very low in the plains under partially shaded conditions of coconut gardens at

Vellayani. Stray flowering was seen on a few surviving plants; but pod setting was totally absent. The results thus indicated the nonfeasibility of cultivating cardamom in the plains.

## ONGOING PROJECTS

### Crop improvement

#### *Germplasm collection (Pampadumpara)*

During the year, the available types and wild relatives were transplanted to another plot. Thirty types and eleven wild relatives of cardamom are available. Comparison of the performance of the types can be made during 1984.

#### *Reproductive mechanism in cardamom (Pampadumpara)*

Floral biology, anthesis, pollination, pollen viability, stigma receptivity, self incompatibility, etc. are studied in the three popular varieties of cardamom-Malabar, Mysore and Vazhuka.

#### *Studies on the effect of irradiation on cardamom (Pampadumpara)*

The irradiated plants have started yielding. Their performance will be compared during next year.

#### *Hybridization (Pampadumpara)*

Gapfilling was done in the plot to which the types were transplanted. Growth characters and yield can be compared from 1983 onwards.

### Crop management

#### *Fertilizer trial (Pampadumpara)*

The trial was started during 1974. Yield data for three years from 1978-79 were collected, tabulated and statistically analysed. The results indicated that the treatments do not differ in their effect on yield. This may be due to the low level of  $P_2O_5$  in the treatments. Revision of the technical programme will be done in the next annual workshop of the co-ordinated project.

#### *Evaluation of different cultural practices (Pampadumpara)*

Yield data were collected and statistically analysed. The results indicated that the treatments do not differ significantly as far as their effect on yield is concerned. The trial will be continued for one more year.

#### *Trace element studies of cardamom soils (Pampadumpara)*

Soil samples were collected during 1976. Action is being taken to analyse the samples.

### Plant protection

#### *Studies on the control of Azhukal disease (Pampadumpara)*

A field trial was conducted during 1980-81 using 14 treatments. The results obtained were tabulated and sent for statistical analysis.

### *Studies on Katte disease I (Pampadumpara)*

Observations were made on plants in the Station for finding out new vectors. No new vector could be observed.

### *Etiology and control of leaf blotch disease (Pampadumpara)*

A field trial was laid out to study the effect of five fungicides on the control of the disease. Data collected were tabulated and statistically analysed. The results indicated that Bordeaux mixture 1%, Bavistin 0.3%, Difolatan 0.3%, Dithane M-45 0.3%, and Hinosan 0.3% are equally effective in controlling the disease. The trial is being continued.

### *Studies on Chenthal disease (Pampadumpara)*

Preliminary studies under the project commenced during 1980. The project will be continued during 1981-82.

### *Studies on the insects and nematodes associated with cardamom (Pampadumpara)*

Under the project, regular observations were made on the incidence of different insect pests and nematodes on seedlings and bearing plants. Three varieties were utilized for a comparative study. Two field trials were started under the project. Results from a field trial were included in the package of practices recommendations for the control of shoot fly in the secondary nursery.

### *Field trial on control of nematodes attacking cardamom (Vellayani/Pampadumpara)*

The objective of the trial was to find out a suitable control measure for nematodes attacking cardamom in nursery. Four nematicides (Furadan, Temik, Nemacur and Methyl bromide) in two doses were tried along with sun drying of soil and burning stubbles. Methyl bromide fumigation in nursery soil was found to be effective in the primary nursery. Application of Nemacur and Temik was found to be effective in controlling nematodes in the secondary nursery.

### *Evaluation of insecticides against cardamom thrips (Pampadumpara)*

Three field trials were in progress under the project. Studies on the effect of skipping insecticide (spray) application after the formation of capsules were conducted during 1979-80 and 1980-81. Conclusions will be drawn after conducting the trial for one more year.

Studies on the effect of different doses and two methods of application of three insecticide dusts were initiated during 1979 and was continued for two years. Since the results of the two years did not agree, it is proposed to continue it for one more season.

Studies on the effect of skipping insecticide application during rainy season were conducted for one season. It will be continued for two more seasons before arriving at conclusions.



*Studies on the role of honey bees in the pollination of cardamom (Observational trial) (Pampadumpara)*

The trial was conducted for two years. The results indicated that maintaining four bee colonies per hectare during flowering season is the optimum for increasing fruit set and yield of cardamom.

*Studies on the adaptability of sericulture in Kerala (Pampadumpara)*

The trial was started during 1979. The rearings have been done. The percentage of silk obtained ranged from 40 to 45. The project is being continued.

*Control of cardamom whitefly (Pampadumpara)*

Implementation of the project has not been commenced since the population of whitefly observed was not sufficient. The project was prepared when the insect was observed as a pest of cardamom.

*Evaluation of Ambush and Cymbush against cardamom thrips (Pampadumpara)*

A trial using the two new synthetic pyrethroid insecticides was conducted during the year. The results indicated that Ambush at 100 ppm and Cymbush at 60 ppm are effective in controlling thrips infestation on cardamom capsules.

## **NUTMEG AND CLOVE**

### **ON GOING PROJECTS**

#### **crop improvement**

*Germplasm collection of nutmeg (Vellanikkara)*

After a survey, fortyeight nutmeg plants were collected from five locations and planted at the Instructional Farm, Vellanikkara. The plants were maintained well; but the survival was less. The plants have not attained the bearing stage. Observation on characters like height, collar girth, number of branches, pattern of branching, spread etc. are being recorded at six monthly intervals.

#### **Crop management**

*Studies on the effect of containers, potting mixtures & growth regulators on growth and survival of clove seedlings (Vellanikkara)*

The seeds collected during May-July were classed according to the weight and sown with and without; peeling the seed coat. Effect of gibberellic acid on germination was studied with GA at 100 to 400 ppm concentrations. Different containers and potting mixtures were tried to study their effect on growth and vigour of seedlings. Survival and growth of seedlings as influenced by the type of containers were also studied. The seeds collected and sown during June recorded the highest percentage of germination. The removal of pericarp increased the rate of germination; but not the rate of growth of seedlings. G A

treatment inhibited the germination. Seedlings from primary nursery transplanted to improvised coconut husk pots filled with potting mixture containing bone meal and groundnut cake gave better rate of growth. Transplanting to the mainfield with the coconut husk pot intact gave better rate of survival.

#### *Observational trial on nutmeg with Celmon (NAA) (Vellanikkara)*

The objective was to find whether NAA preparations had any effect on the fruit drop in nutmeg. Five bearing plants were sprayed with graded doses of Celmon (10,20,30 & 40 ppm NAA). One was left as control by spraying only distilled water. Four spraying were done at different intervals (at the time of flowering, one month after, two months after and three months after). Observation on number of flowers produced, number of fruits set, number dropped, length and girth of fruits, etc. were recorded.

#### *Standardisation of tissue/meristem culture technique in important horticultural crops (Vellanikkara)*

Work has been initiated at the College of Horticulture to assess the potential of tissue culture techniques as aids in propagation of important horticultural crops, to select ideal tissues for each crop and to standardise conditions like culture media, duration, temperature, light, humidity etc. Callus formation and root differentiation were obtained in a few crops using Murashige & Skoog medium with various auxin/kinetin ratios.

#### **Plant protection**

##### *Studies on diseases of clove, nutmeg and cinnamon as occurring in Kerala (Vellayani)*

The causal organisms of nineteen diseases were identified and detailed studies were undertaken. Of the 19 diseases described, 10 are recorded for the first time. Effective control measures have been investigated for three major diseases (leaf spot, twig blight and flower shedding) of clove, shot hole disease of nutmeg and leaf spot disease of cinnamon. Bordeaux mixture and Fytolan were found to be the effective fungicides for the control of these diseases.

##### *Etiology and control of the diseases of major tree spices (Vellayani)*

The aim of the project was to undertake detailed studies on the diseases affecting the major tree spices—clove, nutmeg, and cinnamon.

A survey was conducted on the occurrence of various diseases on these major tree spices in the main localities of Kerala. Diseased specimens were collected and detailed studies were carried out on etiological aspects, symptomatology and fungicidal control of major diseases. It was found that *Colletotrichum gleosporioides* is causing

severe damage to these crops. Comparative morphological, physiological and pathological studies carried out using different isolates showed that there is strain variation in this pathogen which has a very wide host range.

## **GINGER AND TURMERIC CONCLUDED PROJECTS**

### **Crop improvement**

*Multilocational trial on turmeric (Vellanikkara, Mannuthy, Pattambi, Pilicode, Odakkali, Ambalavayal and Vellayani)*

The objective was to study the performance of four turmeric varieties (Mannuthy local-VK 5, Chayapasupa, Armoor and Kuchupudi) in different localities. Selection of the varieties was based on the results of the varietal trial concluded in 1978 in the College of Horticulture. The trial was carried out for two years. In the first year, Mannuthy local gave maximum yield/plot in four out of seven locations. In the second season, there was no significant difference in the performance of the four varieties in three out of five locations. The variety Kuchupudi was found to be significantly superior to Chayapasupa; but on par with others in Pattambi. The same was found to be significantly superior to VK 5 & on par with others in Mannuthy. The variety VK 5 was found to be more resistant to pests and diseases.

### **Crop management**

*Population density trial in turmeric (Vellanikkara)*

Trial was conducted with six different spacings (10 x 20 cm to 30 x 30 cm) for two varieties, Mannuthy local and Kodur. Observations on vegetative and yield characters were recorded. Though the mean yield data for different spacings were found to be statistically significant, specific conclusion could not be drawn. The spacing 25 x 25 cm gave maximum yield; but was on par with other treatments. Among the varieties, Mannuthy local was superior to Kodur.

*Effect of different planting material on growth, yield and quality of turmeric (Vellanikkara)*

The trial was conducted at the College of Horticulture with the variety Mannuthy local (VK 5) with mother rhizomes as the planting material. The finger rhizomes and mother rhizomes were again classed according to the weight of the material. The plants were maintained as per the package of practices recommendations of KAU. Large mother rhizomes of 35-44 gm size were found to give significantly superior yield over the other treatments. But yield of cured turmeric was high with halves of mother rhizomes. Medium to large sized mother rhizomes or split halves of large mother rhizomes could be recommended as the planting material for better production in turmeric.

*Effect of growth regulators on the growth, yield and quality of tumeric (Curcuma longa L.) (Vellayani)*

Of the three growth regulators applied, MH, CCC and Kinetin, MH showed significant effect with respect to reducing leaf area and increasing the number of primary fingers at harvest. At 50 ppm, MH decreased the leaf area. The number of primary fingers at harvest was significantly increased by MH at 25 and 50 ppm. Kinetin at 125 ppm also gave similar results, whereas CCC at 1000 & 1500 ppm decreased it. The yield of rhizomes was not affected by the growth regulators at the concentrations tried. Kinetin at 75 & 100 ppm, CCC at 1000 & 2000 ppm and MH at 50 ppm increased the curcumin content of the rhizomes.

**Plant protection**

*Studies on the phyllosticta leaf spot of ginger (Vellanikkara)*

The symptomatology of the *Phyllosticta* leaf spot was studied in the type Maran. The causal organism was isolated and identified as *Phyllosticta zingiberi*. The germplasm available at the College of Horticulture was screened. None of the 22 types were resistant. Maran was least susceptible. The type Vengara was the most susceptible. One percent Bordeaux mixture and 2000 ppm Bayer 5072 gave complete inhibition of the fungal growth. All the twelve fungicides tested in the field reduced the disease incidence. Cuman was the most effective (32% over control), followed by Bordeaux mixture (29%) and Panolil (25%). Maximum rhizome yield (34% more than control) was recorded by Cuman.

*Studies on the control of soft rot of ginger (Vellanikkara)*

*Pythium aphanidermatum* was isolated from infected rhizomes and the pathogenicity was proved. In the bioassay, complete inhibition was obtained with Agallol (500ppm). Seed treatment with 0.25% Agallol alone was not effective. A minimum of two post-emergence applications (one month and three months after planting) of Cheshunt compound or Agallol in addition to pre-planting soil drenching was found to be necessary for disease control as well as for obtaining good yields.

*Etiology of the bacterial wilt of ginger incited by Pseudomonas solanacearum E. F. Smith and its control (Vellayani)*

The detailed studies carried out showed that the pathogen is *Pseudomonas solanacearum* biotype III. *In vitro* studies revealed that Agrimycin-100 and Ambystin S were most effective, followed by Chloromycetin. Ambystin S gave the maximum field performance giving 70 per cent control. The root knot nematode *Meloidogyne incognita* was found to increase the incidence and speed of development of bacterial wilt of ginger. Incidence and speed of development were maximum when bacteria were inoculated into soil already infested with the nematode.

## ONGOING PROJECTS

### Crop improvement

#### *Germplasm collection of ginger (Ambalavayal)*

A germplasm collection of exotic and indigenous varieties of ginger was established to study their yield potential and to isolate promising ones for extensive cultivation and distribution. 30 different types of ginger were being maintained. During the last season, the entire crop was damaged due to the occurrence of bacterial wilt.

#### *Screening ginger types for partially shaded conditions (Mannuthy)*

An experiment was in progress which aimed at identifying ginger types suitable for partially shaded conditions.

#### *Germplasm collection of turmeric (Ambalavayal)*

A germplasm collection of exotic and indigenous varieties/types of turmeric was established to study their yield potential and other economic characters in order to isolate promising varieties for extensive cultivation and distribution. 33 types of turmeric are being maintained at this Station. During the previous season, the collection had 43 types; some of them were lost due to poor germination under the climatic conditions of Ambalavayal.

#### *Variability in open pollinated progenies of turmeric, *Curcuma aromatica soliah* (Vellanikkara)*

Forty two open pollinated lines were utilised for the study. Genetic variability with regard to various vegetative and yield characters were assessed. Selection was made for high yield, high curcumin and pest/disease resistance. Four lines (D-182, D-199, D-229 & A-78) out of 42 were selected based on dry yield, and curcumin content.

#### *Studies to find out the best turmeric variety for partially shaded conditions (Mannuthy)*

The object of this experiment was to find out the most ideal variety of turmeric for cultivation under partially shaded conditions. Fourteen turmeric varieties were tried in coconut garden. Amruthapani Kottapetta A. 72 recorded the highest yield (23353 kg/ha) followed by Dindigal and Mannuthy local.

### Crop management

#### *Tissue testing with a view to detecting nutrient deficiencies in agricultural and horticultural crops (2): Foliar diagnosis, yield and quality of turmeric in relation to N, P and K (Vellanikkara)*

A field experiment on turmeric with three levels of N, P and K in confounded factorial design was conducted at the Instructional Farm, Vellanikkara. Tissue samples were collected periodically during the period of plant growth for the analysis of chemical constituents with a view to standardise the tissue for foliar diagnosis and to study the

uptake of nutrients, optimum dose and quality aspects. Growth characters and yield were also recorded. Observation on morphological characters revealed that the number of tillers per clump increased with increasing levels of N whereas number of leaves per tiller decreased with increasing levels of N. Levels of P and K did not influence the morphological characters. Maximum dry matter production was observed at K<sub>2</sub> level. The chemical analysis of the samples is in progress.

*Effect of planting date, weight of rhizome and spacing on the growth, yield and quality constituents in turmeric (Vellanikkara)*

A trial is being conducted with Kasthuri Tanak planting materials of different weight (20 to 60 gm). The rhizomes were planted under varying spacing (10 x 20 to 20 x 23 cm) and at different dates (Mid April to beginning of June). The trial is in progress.

**Plant protection**

*Studies on the symptomatology, etiology and control of the new bacterial wilt on ginger in Wynad (Ambalavayal)*

The objectives of the project were the study of the symptoms of disease, isolation and pathogenicity studies of the isolate, assessment of the survival of pathogen in soil in seed rhizomes and evaluation of the resistance of the different varieties in the germplasm. Evolving control measures using antibiotics like Streptomycin, Agrimycin, Plantomycin, Chloramphenicol, Tetracycline, Ampicillin etc. was also intended.

*Control of nematodes attacking ginger (Vellayani)*

The objective of the study is to evolve a suitable control measure for nematodes attacking ginger. Furadan, Temik and Thimet were tried in three doses. The results showed that all the treatments were superior to control. Maximum yield was obtained from the plots treated with Temik @ 4.5 gm/m<sup>2</sup>. The rhizome yield was least in the control plot.

*Studies on the control of nematodes of ginger using nematicides and their residue analysis (Vellayani)*

The objective of the study is to evolve suitable chemical control measures for the nematodes attacking ginger and to find out the residual toxicity of the nematicides applied. The trial is in progress.

**COCOA**

**CONCLUDED PROJECTS**

**Crop management**

*Studies on a deficiency disorder in cocoa (Vellanikkara)*

The disorder reported from the District Agricultural Farm, Koothali, was investigated upon. The symptoms, budding & sap-transmission studies and treatment with ZnSO<sub>4</sub> indicated that the disorder was due to Zn deficiency. Based on the study, 0.5 to 1.5% ZnSO<sub>4</sub> was recommended for overcoming the deficiency.

*Effect of shade and moisture regimes on the growth of cocoa seedlings (Vellanikkara)*

The study involved comparison of three shade intensities (light intensities of 25-30 per cent, 50-60 per cent, 75-80 per cent and 100 percent) and three moisture regimes (25, 50 and 75 per cent available water) on the growth of cocoa seedlings. The results indicated that a light intensity of 50-60 per cent was the best for growth. Irrespective of the frequency of irrigation, seedlings in the open failed to grow.

**Plant protection**

*Investigations on insect pests of cocoa in Kerala with special reference to the mealy bug, *Planococcus lilacinus* (Vellayani)*

The project aimed at surveying the distribution of the pests of cocoa in South Kerala and at working out the biology, ecology and control of the mealy bug affecting cocoa. The survey indicated that 26 species of insects infested cocoa. Of these, mealy bug was the most destructive.

Mealy bug population was positively correlated with the temperature and negatively correlated with rainfall. One generation of the mealy bug was completed within 20-25 days. Pod infestation was effectively reduced by 0.05 per cent concentration of Fenthion, Monocrotophos, Quinalphos and Dimethoate. Stem implantation and soil drenching with systemic insecticides showed that Phosphamidon, Monocrotophos and Dimethoate gave good control of *P. lilacinus* where as soil application of Phorate, Carbofuran and Disulfotolp were ineffective.

**Post harvest technology**

*Small scale fermentation of cocoa bean (Vellanikkara)*

Three methods of fermentation (minibox, mini tray and mini basket) were tested with two quantities (1.5-2.0 kg and 3.0-4.0 kg). Mini box method was found to be suitable for fermenting quantities as small as 2.0 kg, followed by mini-basket. Four layer gunny sack proved to be the best insulating material. Keeping the beans for more than six days resulted in increase of  $P^H$ , blackening of beans and development of superficial mould. Daily turning was found superior; but considering the labour involved, turning once in 48 hours was recommended.

*Development of a small scale cocoa drier (Vellanikkara)*

Attempt was made to fabricate and test a cocoa drier suitable for small quantities of cocoa beans. The source of heat was a set of electric bulbs. A wooden box (90 x 60 x 60cm) with three trays spaced 15 cm apart was made. The power, number and positions of bulbs were standardised. With an equivalent of four 100 W bulbs kept at the bottom, a temperature of between 54-57°C could be obtained in the box in about

2½ hours. The temperature was also nearly uniform within the drier. Test drying showed that about 25kg of wet beans could be dried in 48-72 hours, depending upon the season. The cost of drying came to about Rs 0/50 per kg of dry beans and the initial cost of fabrication, between Rs. 200/- and Rs. 300/-.

## ON GOING PROJECTS

### Crop improvement

*Studies on the floral biology and fruit set in cocoa, Theobroma cacao L. (Vellanikkara)Pilicode)*

The flower production was found throughout the year with two peaks in May-June and November-December. The maximum pod harvest was obtained during June to August season. A second peak was obtained during October-December.

Cherelle wilt was observed to occur throughout the year, maximum being in July. The percentage of cherelle wilt during the first week of pod development was 6.35. It reached a peak of 18.75 per cent at the sixth week. There was no loss due to cherelle wilt beyond the 10th week. Newly emerged flower buds took 21 & 24 days to reach maturity and anthesis. Anthesis commenced between 2 and 4 P.M. and completed between 2 and 4 A.M. the next day. Anther dehiscence commenced between 4 and 6 A.M. and completed by 8 to 10 A.M. Stigma receptivity was found to be high between 12 noon and 2 P.M.

*Genetic variability and correlation studies in cocoa, Theobroma cacao L. (Vellanikkara)*

The study commenced from July, 1980. Observations on 21 plant and pod characters were recorded. Considerable variability existed in the material studied.

### Crop management

*Propagational studies on cocoa (KADP, Vellanikkara)*

This project envisages fixing up criteria for mother plant and seedling selection. Under the first objective, preliminary observations on growth parameters of cocoa plants available at the Banana Research Station, Kannara were recorded. Further studies are in progress.

*Trial on training and pruning of cocoa (KADP, Vellanikkara)*

An experiment has been laid out at the Instructional Farm, Mannuthy to compare the different systems of training. The crop has not yet flowered. Observations on growth characteristics have been recorded.

*Spacing cum manurial trial on cocoa (Vellanikkara)*

The project was started to find out the best spacing for maximum production in cocoa and to standardise the economic and most suitable



fertilizer level for maximising production. The manurial treatments were applied in two split doses (1/3rd in April-May and 2/3rd in September) The project is in progress.

*Effect of graded doses of nitrogen, phosphorus and potassium on the growth and leaf nutrient status in cocoa (Vellanikkara)*

Application of N, P & K to seedlings grown in pot mixture did not improve their growth in terms of height, girth, leaf production and dry matter content suggesting thereby that fertilization of seedlings in the nursery may not be necessary. Leaf ranked fifth from the apex is suggested as standard leaf analysis in cocoa seedlings.

*Nutritional studies on cocoa (KADP, Vellanikkara)*

Under this project, the first objective is to find out the optimum requirement of N, P, K, Ca and Mg. The experiment has been laid out in cultivators' field at Karakulam and Elamba in Trivandrum district and Kannara in Trichur district. Soil and leaf samples prior to application of treatments have been collected. Growth parameters have been recorded for the treatment plants.

In another experiment under this project, a trial to find out the effect of zinc has been laid out at Mannuthy. The experiment is in RBD with five treatments and five replications. The treatments are two levels of zinc (soil and leaf application) and control. The experiment was started in November 1980. Pre-treatment soil and leaf samples have been collected. Growth parameters of the treatment plants have been recorded. The soil and leaf samples are being analysed.

*Performance of introduced cocoa varieties and hybrids under three levels of fertilizer doses (Pattambi)*

The object of the trial is to evaluate the performance of introduced cocoa varieties and hybrids under three different NPK doses. The experiment was laid out with split plot design with varieties/hybrids in main plots and fertilizer doses in subplots, replicated twice.

*Root studies in cocoa (Vellanikkara)*

This project was taken up to study the root distribution of cocoa seedlings in different root media and the pattern of root growth after planting for a period of five years.

*Studies on seasonal variation in cocoa bean size. (Vellanikkara)*

The project was taken up to study the seasonal and location differences in bean weight. Samples received from M/S Cadbury during October 1979, March 80 and April 80 were used for this study. Farmer's samples received also were used. Further observations were also made on the 60 bean samples received from Mr. Hubbard. The bean count was found to vary widely from as low as 81 to as high as 130. All the samples were tested during the summer season.

### *Regulation of cropping in cocoa, Theobroma cacao L. (Vellanikkara)*

This project was taken up to devise methods to regulate the major cropping during the summer months so as to get the optimum bean size.

#### **Plant protection**

### *Control of insect pests of cocoa (KADP, Vellanikkara)*

Based on the survey of pest complex associated with cocoa carried out in the previous year, an experiment has been initiated at the Banana Research Station, Kannara.

### *Investigation on the etiology of fruit drop disease and their control (KADP, Vellanikkara)*

Investigations carried out during previous year on fruit drop disease have identified the organism involved. The symptoms expressed have also been described.

The study was continued and the data on control aspects have shown that phytosanitations was a must for the reduction on the disease incidence. Among the fungicides tried, Bordeaux mixture and Difolatan 0.2% were found to be effective in reducing the various pod infection. The percentage of cherelle wilt was not at all affected by the chemical treatments.

### *Control measures for pink disease, Corticium salmonicolor (KADP, Vellanikkara)*

The data collected showed that application of Bordeaux paste at the fork region and cut ends of the twigs along with Bordeaux mixture spray or application of Thiride paste (2 g Thiride in 1 kg petroleum jelly) at the fork region and at the cut ends along with Thiride 0.2% spray was found to be good in reducing the incidence of pink disease.

### *Studies on the die back disease of cocoa-causes and control (KADP, Vellanikkara)*

From the twigs dried due to die back, *Botrydiplodia* sp. and *Colletotrichum* sp. were isolated. They caused typical die back symptom with withering of leaves. Drying up of twigs was also found in the case of *Cephaleuros* sp. attack on the stem. The Diplodia attack was seen generally during the dry months while *Colletotrichum* was found throughout the year. The data collected so far from the experiment showed that treatments have to be revised as no treatment was able to reduce the incidence for more than six months with a single spray.

#### **Post-harvest technology**

### *Studies on small scale fermentation of cocoa beans (Vellanikkara)*

Seven methods of fermentation (bamboo basket lined with banana leaves, bamboo basket lined with polythene sheet, minibox, small tray-single, set of five trays, small heap with banana leaves and small heap

with polythene sheet) were tried with three quantities and for three duration. Fermenting in bamboo baskets lined with banana leaves with six kg. wet beans for sixdays duration was found to be the best.

*Method of fermentation and drying (Vellanikkara)*

This work is in collaboration with Mr. FTP Hubbard, F. A. Consultant who had done work on fermentation and drying at the Cadbury Fermentary at Vadavathur, Kottayam. The quality of beans fermented by a new type of box fermentation is to be compared with those by the normal tray method.

*Studies on cocoa bean acidity (Vellanikkara)*

This experiment was taken up to study the pH of beans fermented by the recently developed small scale methods of fermentation. Beans from minibox, mini tray, mini basket (2,2.8 and 4 kg) methods were compared. The beans were dried at 40,50 and 60°C and also by staggered drying (40°C for the first 24 hours, followed by 80°C to complete drying). The pH of beans ranged from 5.71 to-6.44 (well beyond safe limits) The basket method appeared to give beans of lower pH among the methods. Higher temperature of drying tended to lower the pH.

The seasonal and elevation effects on cocoa bean pH was also studied. Cocoa beans were collected from Kottayam, Thamarassery and Chundale every month for estimation of pH. This work was done in collaboration with M/S. Cadbury (India). Three sets of samples were received during October, 1979, March 1980 and April 1980. Data are given below:

Samples from	pH of samples obtained in		
	October '79	March '80	April '80
Chundale	5.50	5.75	5.80
Kottayam	—	4.90	5.10
Thamarassery	5.36	4.90	—
Farmer-Calicut	6.04	5.05	5.50
Cadbury sample	6.02	—	—

No consistent seasonal or location differences in the pH of cocoa beans was observed.

A collaborative work with Dr. Shepherd, Director of Research, H&C Malaysia is also planned. The work essentially involves estimation of the monthly variation in the amount and proportion of pulp, the size of the cocoa beans and relating these with environmental factors (rainfall and temperature). The work would be one in India, Sumatra and Malaysia.

*Studies on the storage of cocoa beans (Vellanikkara)*

This experiment was taken up to assess the life of cocoa beans stored in different containers. Gunny bag, gunny bag + poly bag

(150 g), gunny + poly bag (200 g) gunny + poly bag (400 g) polythene coated gunny, CARE bag and poly balloon system were used as containers. Each container was filled in December 1980 with 15 kg of beans and each set was replicated four times. The observation included moisture content, cut test and p<sup>H</sup>.

## CASHEW AND FRUITS

### CASHEW

#### CONCLUDED PROJECTS

##### Plant protection

##### *Studies on fungi associated with cashew with special reference to immature fruit drop (Anakkayam)*

The study established the pathogenicity of various fungi associated with cashew especially relating to immature fruit drop. Pathogenicity of *Pestalotia* sp. causing leaf spot and *Colletotrichum* causing leaf blight and immature fruit drop was also established. Varietal screening of cashew types against leaf blight revealed the types H-4-7, K-25-2 and K-22-1, as moderately resistant, NLR-2-1, K-19-1, K-10-2, UL-28-1, K-28-2 and K-18-2 as moderately susceptible, and BLA-273-1 and H-3-17 as susceptible types based on a 0 to 4 scale. *Colletotrichum gloeosporioides* infection was found severe during December January, February and at the time of emergence of new flushes.

It was also possible to isolate the fungi *Aspergillus* sp. and *Rhizopus* sp. from kernels of stored cashewnut.

##### *Study on varietal resistance and control of die back disease on cashew using newer fungicides (Anakkayam)*

The study revealed that the disease intensity can be controlled effectively by Calixin 10.1% treatment. Bordeaux Mixture 1% and Difolatan 0.2% were also found to be suitable for controlling the die-back disease of cashew.

#### ON GOING PROJECTS

##### Crop improvement

##### *Collection and maintenance of types (Anakkayam)*

A collection of 90 types were maintained. Eventhough eight new clonal types were collected from various parts, they failed to establish. Maximum yield was recorded by the type NLR-2-1 followed by K-19-1 and K-10-2. Out of 47 clonal types, 21 progenies gave yield more than 10 kg. nuts/tree. In the seedling types, BLA-139-1 continued to maintain its lead by giving 29.3 kg. nuts/tree.

*Studies on F2 progenies and double cross hybrids (Anakkayam Vellanikkara)*

Hybridization and selfing were undertaken with the 13 parental combination as per the technical programme.

*Comparative yield trial of certain types of cashew (Anakkayam)*

Since the planting materials used are layers and since the soil is lateritic, the establishment of plants was a problem. The 22 gaps were filled in June, 1980. However, only 13 established leaving a gap of nine trees during the year after the commencement of the experiment. A progeny of type K-28-2 giving a yield of 7.69 kg (planted on 7-8-1974) ranked first. The types K-10-2, BLA-39-4, H-4-7, NLR-2-1, H-3-13, K-28-2, H-3-17, K-19-1, and UL-28-1 gave fairly good yields.

*Breeding improved varieties of cashew (Anakkayam)*

216 hybrid progenies were maintained. Evaluation of economic and other important characters of hybrids planted since 1972 was continued. New hybridization was also undertaken.

*Study of promising clonal types (Anakkayam)*

Out of the types planted in 1967, the type T-34 recorded the highest mean yield of 7 kg. nuts/tree, followed by H-3-9 (6.12kg). In the 1968 planting, K-10-2 recorded the highest mean yield of 3.460 kg. followed by H-3-17 (2.910 kg. nuts/tree). The trees of the 1974 planting have not started giving consistent yield. However, the highest yield of 2.24 kg. nuts was given by a progeny H-4-7. The type H-3-13 which was a high yielder (5.830 kg. of nuts during the year) almost dried up due to stem borer attack. However, clonal progenies have been raised to perpetuate the type. During the year, hybridization was taken up with various parental combinations and seeds could be collected from the combinations as below which will be planted during 1981-82.

*Seedlings progeny analysis in selected cashew types (Vellayani)*

A total of 60 mother trees belonging to two different varieties of cashew were selected from the Cashew Farm, Kottarakkara. The selection of mother trees was based on flowering type, uniformity in age and growth pattern. Basic observations like girth of the trunk, canopy size and ratio of male and hermaphrodite flowers in each panicle were made. The seed collection is in progress.

*Survey and collection of superior genotypes (KADP, Vellanikkara)*

The survey and collection was started in 1979. Cannanore and Malappuram districts have been covered. At present, 39 surviving plants are maintained at Vellanikkara. Attempts to obtain species of *Anacardium* from Brazil by the Plant Introduction division of IARI did not materialise because of lack of response from Brazil.

*Genetic improvement by hybridization and selection (KADP, Vellanikkara)*

The object of the trial was to improve the nut size and to induce earliness into otherwise high yielding varieties. Twenty three sets of crosses were effected utilizing the types available at the ICAR project. The F1 seeds from the above crosses will be raised in the next season.

*Germplasm collection in cashew and description of varieties (Madakkathara)*

Trees belonging to 65 types out of 93 accessions have flowered and started yielding. The yield ranged from 100 grams to 7.200 kg. of nuts per tree. The highest yield of 7.200 kg. was recorded by tree No. 2052, followed by tree No. 1966 (5.250 kg.).

*Breeding improved varieties by hybridization (Madakkathara)*

Hybridization was first initiated in this centre during 1976. At present, 289 hybrid progenies (including the 199 obtained by crosses at Anakkayam and planted at this centre during 1973) are under detailed study. Out of the 199 hybrid progenies planted in 1973, tree No. 662 of the hybrid H. 24 recorded the maximum yield of 13.930 kg. nuts followed by tree No. 684 of hybrid H. 23 (13.400 kg) and tree No. 681 of hybrid H.23 (11.950 kg.)

*Comparative yield trial of Anakkayam selections and hybrid progenies - Air layers (Madakkathara)*

During the year under report, the maximum mean yield of 8.693kg. nuts per tree was recorded by the hybrid, H-3-17 followed by BLA-39-4 (6.927 kg) and H-3-13 (6.460 kg).

*Comparative yield trial of existing high yielders of cashew-seedlings (Madakkathara)*

During the year under report, the Anakkayam type K-27-1 recorded the maximum mean yield per tree (5.510 kg), followed by the Vridhachalam types M-76/1 and M-6/4 recording 3.440 kg and 3.160 kg, respectively.

**Crop management**

*Fertilizer trial in cashew (Madakkathara)*

The trees were uniformly fertilized at 500 gN, 250 g P<sub>2</sub>O<sub>5</sub> and 250 g K<sub>2</sub>O during the first five years after planting. The differential doses of fertilizers were given during 1979 after calibrating the trees on the basis of their yields during the previous three years. The statistical analysis of the yield data for 1980-81 indicated that the treatments were not significant.

*Standardisation of seedling selection technique (Madakkathara)*

Studies in the nursery indicated that the weight of nuts had positive correlation with height of seedlings and no. of leaves. Weight of nuts had negative correlation with girth and internodal length of seedlings.

### *Propagational trials in cashew (Madakkathara)*

The trial is continuing since 1974. The results so far indicated that the best time for inarching, side grafting, veneer grafting and budding was from May to October. The maximum survival percentage was obtained during June to August. In the case of stone grafting, March to May was ideal for maximum survival.

### *Hormone application to increase fruit set in cashew } (Madakkathara)*

The results of the seven-year trial categorically revealed that none of the hormones tried could bring about an appreciable control of the fruit drop and contribute to an increase in the yield in cashew.

### *Standardisation of layering medium (Madakkathara)*

The results revealed that Tr.3 (wood shavings) with a percentage mean of 42.5 and Tr.2 (sphagnum moss) with a mean percentage of 40.0 were significantly superior to the others.

### *Standardisation of planting medium and containers in the nursery (Madakkathara)*

An experiment was laid out to find out the best planting medium and container for cashew air-layers. The media used were coconut pith, wood shavings and ordinary potting mixture. The containers were polythene bag, coconut husk fibre container and paddy straw container. Ordinary potting mixture in polythene bag was as good as the other media and containers.

### *Cultural trial on cashew (Anakkayam)*

Various cultural treatments were applied as per the technical programme. It was found that the 'no cultivation' treatment in cashew made it difficult for conducting plant protection operations and harvesting. Thus it gave more chance for excessive tea-mosquito attack. Eventhough this was the eighth year of planting, most of the trees have not started yielding.

### *Multilocational fertilizer trial on cashew in cultivator's field (Parappanangadi)*

During the year, fertilizer application was done in the plot at Parappanangadi. Statistical analysis of the data showed that the results were not significant.

### *Effect of magnesium, copper and iron on the yield of cashew (Anakkayam)*

The micronutrients were applied as per the programme. The treatments did not show any increase in the yield of cashew.

### *Spacing trial with cashew air layers (KADP, Vellanikkara)*

The trial was laid out using air layers in 1979. The layers did not establish. The experiment was re-planted during August 1980 using air layers of K-22-1. A spacing trial with cashew seedlings of K-22-1 has also been laid out.

### *Standardisation of vegetative propagation in cashew (KADP, Vellanikkara)*

Stone grafting and budding by Forkert method using cashew seedlings were found to be not successful. In another study conducted on rooting of cashew airlayers using different media, tree to tree variations were observed in the percentage of rooting of layers. No significant difference was observed between the five media compared. The addition of rock phosphate also did not increase the rooting percentage.

### *Nutritional studies on cashew (KADP, Vellanikkara)*

The experiment was laid out in 1979. The fertilizer as per treatments have been applied. Individual tree yields and growth parameters have been recorded. A few trees have started flowering and some have started bearing. A part of this trial, nutritional studies, has been carried out on yielding trees in farmers' field also. Two such plots have been selected in Trichur district in the lateritic area and one in the sandy coastal belt of Malappuram. The fertilisers have been applied in two plots in Trichur. The pre-treatment yield data have been recorded for the plot selected in the coastal sandy soil.

### *Orchard management practices: Intercropping in cashew (KADP, Vellanikkara)*

A trial to study the most economic intercrop in cashew garden, was laid out at Vellanikkara, using the seedling progenies of BLA-39-4. The yield and growth characteristics were recorded. The data showed that girth of trees was lowest in plants intercropped with lemongrass, while girth was highest in the plants intercropped with cowpea. Maximum height was observed in the plots intercropped with pineapple, followed by those with cowpea. With regard to spread (both N-S and E-W), cowpea plots and pineapple plots had maximum spread. The lemongrass plots recorded lowest height, girth and spread.

### *Cultural trial on cashew (KADP, Vellanikkara)*

A cultural trial was laid out at Vellanikkara to find out the suitable orchard management practices for cashew. The experiment consisted of five treatments, (T1) sickle weeding the interspace between cashew, (T2) light digging 2m around the plants (T3) Treatment 2 + mulching, (T4) polythene cover 2m radius and (T5) cover cropping. The growth characteristics and moisture content at different depths around the trees have been estimated. Treatment 3 was more effective as regards retention of moisture in the soil.

### **Plant protection**

#### *Studies on control of stem borer (KADP, Vellanikkara)*

This trial was aimed at finding a suitable control measure for the stem borer. Two plots for the conduct of the trial were selected at Anakkayam Cashew Research Station, besides one cultivator's plot at Parappanangadi.



## **BANANA**

### **CONCLUDED PROJECTS**

#### **Crop management**

##### *Nutritional requirement of banana cv. robusta (Kannara)*

Result of the experiment indicated positive response to application of phosphorus and potash, whereas nitrogen failed to exert any effect on the performance.

##### *Frequency of application of nitrogen and potash to irrigated banana cv nendran (Kannara)*

The optimum time and frequency of application of nitrogen and potash to banana variety nendran under irrigated condition was found to be in two splits, 30 and 150 days after planting.

##### *Trace element studies in banana (Kannara)*

The response of banana to micronutrients were found to be erratic.

##### *Monthly planting trial in irrigated banana (Kannara)*

The best period for planting banana under irrigated condition was found to be from August to October.

##### *Monthly planting trial under rainfed conditions (Kannara)*

Experimental results showed that planting from August to October was preferable to planting in other months.

##### *Population density trial in banana varieties robusta and monsmarie (Kannara)*

The trial indicated that a population of 4900 suckers per ha was acceptable on a cost-benefit analysis.

##### *Ratooning trial in banana (Kannara)*

Four varieties (Giant governor, Robusta, Pedda pacha and Monsmarie) were tried. The ratoon crop did not give as much yield as the plant crop, thereby indicating that ratooning was not advisable in these varieties.

##### *Water requirement studies in banana (Kannara)*

Experimental results showed that treatments did not differ significantly. ✓

#### **Plant protection**

##### *Role of parasitic nematodes on the occurrence of kokkan disease of banana (Kannara)*

Parasitic nematodes extracted from the 'Kokkan' affected plants and soil were inoculated to the healthy plants raised in sterile soil. The results indicated that nematodes are not responsible for the occurrence of kokkan disease of banana.

*Studies on 'kokkan' disease of banana (Kannara)*

So far, no positive results were obtained to prove that 'kokkan' disease is of viral origin. Similarly, no pathogenic organism could be isolated from the root samples of kokkan infected plants.

*Effect of treating suckers with Furadan for the control of rhizome weevil and other pests (Kannara)*

The results of this study indicated that the incidence of 'dead heart' caused by rhizome weevil and the population of "banana aphid" can be reduced considerably by the application of Furadan 3 G @ 50 g per plant at the time of planting.

*Studies on the control of diseases of banana bunchy top disease (Kannara)*

Twenty nine varieties of banana were screened against the bunchy top virus, by artificial inoculation with infective aphid *Pentalonia nigronervosa*. Kanchikela, Karpooravally, Vadakkankadali, Vennethukunnan and Sannachenkadali were found tolerant to bunchy top disease.

*Granular insecticides on the control of bunchy top disease (Kannara)*

The results of three year's trial indicated that both foliar application of insecticides and soil application of the granular insecticide were significantly effective to control the banana aphid. When considering the mean number of aphid population, Thimet and Disyston were found to be highly effective in controlling the aphid (*Pentalonia nigronervosa*) responsible for the spread of bunchy top disease.

*To find out the intensity and extent of damage caused by diseases, bunchy top|chlorosis|mosaic (Kannara)*

The study conducted at various districts revealed that the maximum percentage of infection was noticed in the varieties Nendran, Red banana, Poovan, Palayankodan and Robusta. Lesser percentage of infection was noticed in the varieties, Koombillakannan Peyan Monthan and Njalipoovan.

## ON GOING PROJECTS

### Crop improvement

*Cytotaxonomical studies of banana cultivars (Vellanikkara)*

One hundred banana cultivars were collected and planted to the field.

*Biometrical studies in banana (Kannara)*

From the germplasm collection of banana maintained in the Banana and Pineapple Research Station, Kannara, 50 types of diversified origin representing the wide spectrum of variability present in the material were selected in January 1981. The experiment will be laid out in 50x 3 RBD in October–November 1981.

*Intraclonal variations and nutritional studies in banana var. 'Palayankodan' (Kannara)*

The objectives of the study were to assess the natural genetic variability among the Palayankodan types and to arrive at the best manūrial schedule for Palayankodan variety. A survey was conducted covering all the districts of Kerala and 24 clones were collected and planted in March 1981 in a replicated trial.

*Clonal variation studies in banana var. nendran (Kannara and Vellanikkara)*

The results showed that definite clonal variation existed among the nendran types grown in the different tracts of Kerala. Clones from Pampady-Meenadom area in Kottayam Dt. recorded the highest mean bunch weight (12.5 kg). Out of the 144 clones planted, 47 were selected, based on bunch weight and other characters.

Three suckers from each of the selected clones were planted in progeny rows during the period.

*Flower initiation studies in banana varieties of three maturity groups (Kannara)*

The object of the trial was to find out the time of flower initiation in four banana varieties under three maturity groups. Preliminary studies were over and detailed studies will be taken up next year.

*Varietal collection in banana (Kannara)*

A total number of 152 varieties were maintained and studied.

*Breeding investigations—Induction of mutations in nendran banana by irradiation and chemical treatment (Kannara)*

To create genetic variations in the nendran variety of banana and to select desirable mutants, irradiation of the suckers was done earlier. One mutant was isolated in the  $M_2$  generation. This was harvested. The bunch had 68 fingers. Suckers from this plant were collected for further tests.

**Crop management**

*Physiological deterioration of seed material in banana var nendran (Kannara)*

To assess the yielding potential of the rhizome of the mother plant in continuous planting for a period of four years, five suckers of uniform size and age were planted and grown. Data on yield and ancillary characters were gathered.

*Effect of pre-and post-harvest treatments on storage and quality of banana var. nendran (Vellanikkara)*

The study indicated that the fruit growth is a continuous process till 90 days after shooting. The length, girth, volume and weight of fingers continue to increase rapidly during early stages and reach 90 per cent growth by 60 days after shooting. The starch and dry matter accumulate during the first two months. The study showed

that rainfed nendran can be harvested from 70 days after shooting without impairing quality. Application of 2, 4-D as preharvest spray on the 60 th day after shooting increased the size, weight and quality of fruits. Polythene bag with potassium permanganate increased the storage life of banana by 10 days. Anthracel at 0.05 % and 0.01%, Bavistin at 500 ppm and 1000 ppm, Thiride at 0.1% and 0.2% were equally effective in reducing the anthracnose disease in storage.

*Performance of clonal progenies from different yield groups and in relation to size of suckers in rainfed banana, Musa (AAB Group) Palayankodan (Vellanikkara)*

The parental generations were grouped into four groups based on bunch weight. Suckers were selected from three groups based on weight. The experiment was laid out.

*Potassium nutrition in rainfed banana Musa (AAB Group) Palayankodan (Vellanikkara)*

The experiment was laid out for assessing the potassium nutrition of Palayankodan under rainfed conditions.

*Nitrogen nutrition in rainfed banana cv. Palayankodan (Vellanikkara)*

For the variety Palayankodan under rainfed conditions, a fertilizer dose of 100 g N, 200 g P<sub>2</sub>O<sub>5</sub> and 400 g K<sub>2</sub>O<sub>1</sub> was found to be the best in the plant crop. The ratoon crop obtained from the plant crop was maintained without any fertilizer application to study the residual effect. It was found that even with skipping fertilizer for ratoon crop, the yield was not considerably reduced.

*Nutritional requirement of banana var. Palayankodan under rainfed conditions (Kannara)*

The treatments consisted of three levels of NPK in factorial combinations, replicated twice. The experiment was conducted for one season and will be repeated in the coming season. The ratoon crop was maintained for study. The results of first season trial indicated that N had profound influence in increasing the bunch weight, the highest bunch weight being recorded by plants receiving 300g N/plant. Phosphorus did not influence the growth and yield of bunches. K gave increased number of fingers/bunch, the maximum number being recorded by the application of 200 g K<sub>2</sub>O/plant.

*Effect of different ratios and levels of NPK on the growth, yield and quality of banana var. nendran (Kannara)*

Three levels of N (150, 200 and 250 g/plant) and three levels of K (300, 400 and 500 g/plant) in all combinations were applied along with a control plot. Phosphorus was uniformly applied to all treatments at the rate of 150 g/plant except in controls. In the control, P was applied at 200 g/plant. Yield data showed no significant difference between the treatments.

*Efficiency of applied nutrients in banana cv. nendran under conditions of liming, split application and in the presence of nitrification inhibitors (Kannara)*

The first experiment was a factorial experiment in RBD. Treatments consisted of combinations of three levels each of N (150, 225, 300 g/plant) and K (300, 450, 600 g/plant). No amendment was included.

The second experiment was split application of N and K with and without inhibitors.

The first crop was over and the experiment was repeated during the year.

*Scheduling irrigation for banana based on IW/CPE ratio under mulched and exposed conditions (Chalaky)*

The effects due to the irrigation levels and mulching were significant; but their interaction was not significant. Scheduling irrigation at IW/CPE ratio of 1.2 gave significantly higher bunch yield over other treatments and was on par with IW/CPE ratio of 0.9. It indicated that scheduling 5 cm irrigation at IW/CPE ratio of 0.9 is adequate under the prevailing conditions. It amounted to ten irrigations at fortnightly intervals. The bunch weight under mulching with 3.5 kg paddy straw per plant was 22% more than that under exposed conditions. The experiment will be continued for two more years to draw conclusions.

**Plant protection**

*Studies on nematode parasites of banana (Kannara)*

The programme was to survey the extent of population of nematodes present in banana growing areas and to establish pathogenicity levels of different types of nematodes prevalent in the tracts.

The nematodes, *Radopholus similis*, *Meloidogyne incognita*, *Pratylenchus sp.*, *Helicotylenchus sp.*, *Hoplolaimus sp.* and *Tylenchorhynchus sp.* were found to be associated with the crop in the banana tracts of Trichur district.

Pure culturing of *Helicotylenchus sp.*, *Radopholus similis* and *Pratylenchus sp.* on banana plants also was started for the conduct of pathogenicity tests.

*Control of banana rhizome weevil by insecticidal treatment of suckers (Kannara)*

The results showed that insecticidal treatment of suckers reduced the infestation of rhizome weevil and increased the yield. Metasystox was found to be effective, followed by Nuvacron and BHC.

*Control of banana rhizome weevil with insecticides applied around the rhizome in the soil (Kannara)*

Thimet application followed by Furadan, Carvint and Heptachlor were found to be effective in increasing yield.

*Studies on insect pests of banana and their control: Resistance of important banana varieties to attack by banana rhizome weevil (Kannara)*

The object of the experiment was to screen banana varieties against the attack of banana rhizome weevil. Five varieties were screened against the attack of banana rhizome weevil (releasing three pairs of weevil to each of the plant, one month after planting). The result showed that varieties "China" "Chenkadali" and "Chakkara Kadali" were highly susceptible to weevil attack, while "Lakatan" and "Anakomban" were least susceptible.

*Screening banana varieties against bunchy top disease (Kannara)*

Four varieties were screened and it was found that Palayankodan and Poovan were highly susceptible to bunchy top disease. No infection was noticed on other varieties under trial.

*Fungal diseases of banana and their control (Kannara)*

Seven chemicals were tried. Highest bunch weight was recorded in plots treated with Difolatan, followed by Thride and power oil + Dithane M 45.

*Screening banana varieties against leaf spot disease (Kannara)*

The objective was to find out the comparative resistance of the different varieties of banana against leaf spot disease. The varieties Red banana, Chenkadali, Sanne Chenkadali, Pisang.lilin, Tomgate, Adakkakunna and Thiruvananthapuram were found to be tolerant to leaf spot disease as compared to other varieties.

*Studies on the persistence and dissipation of systemic insecticides in banana when used for the control of banana aphid (Vellayani)*

The object of the experiment was to find out the minimum number of application of systemic insecticides needed to give protection to banana from aphid infestation and to find out the residue in the fruit. During the previous year, Phorate, Carbofuran, Disulfotan and Aldicarb were applied and their persistence was assessed in the plants. It was found that Disulfotan persisted most, followed by Phorate and Carbofuran. During this year in the 2nd trial also, Phorate and Disulfotan were applied at the planting time. Phorate persisted upto four months and Disulfotan, upto six months.

*Population dynamics of banana nematodes (Vellayani)*

The object of the trial was to study the build up of nematodes in banana from planting to harvest. *Radopholus similis*, *Helicotylenchus* sp. *Pratylenchus* sp. and *M incognita* were present in the soil and roots. The population of nematodes will be studied in relation to the soil moisture.

*Effect of Phorate applied for the control of bunchy top vector of banana, Pentalonia nigronervosa coq, on the plant and in the soil environment (Vellayani)*

The objective was to study the effect of continuous application of Phorate on the soil environment and its uptake, translocation and metabolism by the plants in relation to growth stages of the crop in different seasons of the year. The experiment is in progress.

*Pathogenicity of burrowing nematode, Radopholus similis on banana (Vellayani)*

The studies aimed at finding out the damage caused by different levels of the burrowing nematode in banana. A pot culture experiment was laid out at four levels of populations of nematodes at various stages of the crop. Symptoms damage, losses and threshold populations were estimated.

## **PINEAPPLE**

### **CONCLUDED PROJECTS**

#### **Crop improvement**

*Varietal trial in pineapple (Kannara)*

Nineteen varieties of pineapple were studied in detail.

#### **Crop management**

*Studies on the effect of growth regulators in inducing flowering in 'Kew' pineapple (Kannara)*

Application of Ethrel 25 ppm in combination with 2% urea and 0.04% calcium carbonate induced uniform flowering in pineapple. This was the cheapest of the various chemical treatments used for flower induction.

*Effect of plant growth regulators on fruit size and maturity in pineapple var. 'Kew' (Kannara)*

Experiments have indicated that fruit weight can be increased by spraying of 200 ppm, Planofix, two months after flowering.

*Standardization of time of application of growth regulators on pineapple (Kannara)*

It was found that 16-17 months after planting of the suckers, application of growth regulators can be made for inducing flowering in pineapple.

*Selection of optimum size of suckers based on leaf number (Kannara)*

Studies have shown that suckers having 18-22 leaves are ideal for planting.

*Nutritional studies in pineapple (Kannara)*

Result indicated the superiority of soil application of nitrogen over foliar spray. However, 75% of N applied to soil and 25% as foliar spray was also better than other treatments (50% N foliar and 50% N in soil; 75% N foliar+25% N in soil.)

### *Population density trial in pineapple var, 'Kew' (Kannara)*

Different population densities for planting pineapple were tried in two and three rows per trench. Two-row method of planting was found to be better than the one-row method. A spacing of 25cm between plants, 45cm, between rows and 105cm between trenches (25 x 45 x 105) accommodating approximately 49000 plants/ha was found to be the optimum under Kerala conditions for higher tonnage in a plant crop.

### *Control of weeds in pineapple with the aid of herbicides (Kannara)*

Application of 'Diuron' @3kg/ha as pre-emergence and repeated application at half the first dose five months after planting was found to control weeds in pineapple gardens.

## ONGOING PROJECTS

### Crop Improvement

#### *Adaptive trial in pineapple to compare the results of research with local practice (Vellanikkara)*

The object of this experiment was to assess the comparative effectiveness of high density population, chemical weed control and artificial induction of flowering in comparison with local practice of pineapple cultivation. The study was continued after the first plant crop. Effect of the two treatments on fruit size and productivity in the first ratoon crop was studied during the period.

The results revealed that there was no significant difference in fruit weight without crown. Fruit weight (with crown) and crown weight were significantly higher in local method of planting.

#### *Breeding pineapple for better quality (Vellanikkara)*

The objective of the experiment was to improve the edible quality of the 'Kew' variety of pineapple and to develop new varieties for table purpose and with high yield potential with built-in resistance to the mealy bug. During the year, cross between Kew and Queen (including reciprocal) were made.

#### *Standardization of type and size of planting material in pineapple (Vellanikkara)*

The object of this experiment was to find out the optimum type and size of suckers. Leaf characters recorded at six monthly intervals revealed that leaf number as well as length and width of D leaf were highest in plants raised from suckers of 751 to 1000 g weight. Suckers in the weight group of 501 to 1000 g were found to be the best planting material. They flowered early. Observation of fruit characters, quality analysis etc. were made during the year.



### *Use of crown splits in pineapple propagation (Vellanikkara)*

Pineapple crowns were split into four to eight pieces depending on the size. These were then dipped in different fungicides for five minutes and planted in the nursery. Results indicated that the crown splits treated with Difolatan (0.2%) gave good rooting.

### **Crop management**

#### *Potash requirement of pineapple var, Kew (Vellanikkara)*

Data on growth characters revealed that there was no significant difference in the leaf characters due to different levels of K, twelve months after planting. At the 18th month, treatments differed significantly with respect to length, width and weight of D leaf. In all the above characters, 16 g K<sub>2</sub>O/plant was found significantly superior to the other levels. Harvesting and quality analysis of fruits were also done during the year.

#### *Nitrogen requirement of Kew pineapple (Vellanikkara)*

Growth characters were recorded six months after planting. Data revealed that none of the characters were significantly affected by the treatments.

#### *Phosphorus requirement of pineapple (Vellanikkara)*

The data so far collected showed significant difference in the width of D leaf only, the D leaf of the control plots being narrower.

#### *Standardization of depth of trench for planting pineapple (Vellanikkara)*

At the sixth month, length, width, weight and area of the D leaf showed significant differences. Highest value was recorded in the treatment with 43036 plants/ha planted at a depth of 30 cm, followed by the treatment with same population density planted at a depth of 22.5 cm. There was no significant difference in leaf production among the treatments.

#### *Regulation of fruit size and maturity in pineapple (Vellanikkara)*

The best time for the harvest of fruits was found to be between 132 and 135 days after the emergence of the inflorescence. Application of NAA was found to increase the fruit size, the maximum being at 300 ppm NAA applied one month after the emergence of inflorescence. Maximum delay in fruit maturity was observed by the application of 300 ppm NAA. The application of NAA, especially at higher concentrations, resulted in the reduction of fruit quality. It was also found that the reduction in fruit size associated with lower leaf number would be improved by the application of NAA.

### **Plant protection**

#### *Survey of pineapple diseases (Kannara)*

The survey revealed that a mild infection of leaf spot disease caused by *Drechilera hawaiiensis* was prevalent in Trichur district.

### *Survey and control of pineapple nematodes (Kannara)*

A survey conducted in Trichur district, revealed the presence of *Rotylenchulus reniformis*, *Meloidogyne* sp., *Helicotylenchus* sp., *Pratylenchus* sp. and *Tylenchohrynychus* sp. Pure culturing of *R. reniformis* and *Meloidogyne* sp. was done to build up the population required for the pathogenicity tests.

## **JACK**

### **ONGOING PROJECTS**

#### **Crop improvement**

*Flowering, floral biology and fruit development in 'Varikka' and 'Koozha' forms of jack, Artocarpus heterophyllus L. (Vellanikkara)*

The study was initiated to gather data on flowering, floral biology and fruit development in the two important types of Kerala.

*Germplasm collection and description of types (Vellanikkara)*

The objective was to collect superior types of jack fruit from different parts of the state for further studies. Survey was conducted in Trichur, Ernakulam, Alleppy and Idukki districts and 72 types were collected. Out of these, 33 types were selected. Seedlings from 60 types selected during the previous year and grafts of 35 types obtained during the year were transplanted.

#### **Crop management**

*Standardisation of propagation technique in jack (Vellanikkara)*

Stone grafting was attempted with scions and root stocks of different age groups.

*Manurial trial on jack (Vellanikkara)*

In order to study the effect of NPK fertilization on the growth of jack, an experiment was laid out at Mannuthy.

## **MANGO**

### **ONGOING PROJECTS**

#### **Crop improvement**

*Germplasm collection of mango (Vellanikkara)*

A collection of 30 varieties and hybrids of mango were maintained. The data on growth and flowering were recorded.

#### **Crop management**

*Effect of Ethephon, NAA and GA on flowering and fruit set in mango (Vellanikkara)*

Application of Ethrel in concentrations ranging from 100 to 300 ppm was found to be effective for inducing flowering in young mango trees.

*Nutrition studies in mango (Vellanikkara)*

The fifth year fertilizer application as per the technical programme was done during Aug. Sept., 1980. Before the application, the vegeta-

tive characters of the plants (height, girth and spread in N-S and E-W directions) were recorded. The data taken were subjected to statistical analysis. It was seen that the different fertilizer treatments did not have any significant influence on the vegetative growth of the plants. Even with lower doses of NPK during the pre-bearing years, the mango plant had satisfactory vegetative growth. Regarding flowering, more number of plants started flowering in Treatment 3 (higher doses of NPK) in both varieties (Neelum 66.67% of plants started flowering and in Prior, 35.71%).

#### *Regulation of flowering and fruiting in mango (Vellanikkara)*

Seven mango varieties of medium age group were given light pruning in October, 1980. The pruning of old unproductive trees consisted of heading back the branches which were affected by Ioranthus. The trees were pruned in November, 1980. The studies showed that pruning mango trees of medium age group (by removing the excess vegetative growth and by opening up the centre of the tree) was helpful to increase flowering and yield. The effect of pruning was pronounced in the first year which gradually declined in subsequent years. Very old unproductive mango trees could be rejuvenated by heading back the branches, leaving selected branches. The trees would become productive within five years.

#### *Micro-nutrient trial on mandarin (Ambalavayal)*

In order to evolve the optimum doses of micronutrients like Zn, Mn, Mg and B for mandarin oranges under Wynad conditions, 200 plants were raised. The different treatments are to be given during 1981.

#### *Standardisation of agro-techniques (moisture conservation trials) in coorg mandarin under Wynad conditions (Ambalavayal)*

The different treatments were started during 1979. *Calapagonium muconoides* was employed as the cover crop. The growth measurements of the plants were recorded. The experiment is in progress.

#### *Control of weeds with herbicides in citrus orchards (Ambalavayal)*

The use of pre- and post-emergence weedicides in citrus orchards did not produce any significant effect in reducing the weed population. The experiment is in progress.

### **Plant protection**

#### *Chemical control of citrus psylla, aphids and white flies (Ambalavayal)*

Survey for pests was in progress. The black aphid, green aphid (*Donsalis pomi*) as well as nymphs and adults of the pentatomid bug (*Coppica laprobanica*) were observed in the plantation.

#### *Chemical control of scale insects (Ambalavayal)*

The experiment was laid out with nine treatments in RBD. The different treatments will be given in 1981.

### *Chemical control of leaf fall and fruit rot (Ambalavayal)*

The disease has not yet appeared under field conditions and therefore the experiment has not been started.

## **CITRUS**

### **ONGOING PROJECTS**

#### **Crop improvement**

##### *Adaptability trial on acid lime seedlings (Vellanikkara)*

During 1980-81, it was observed that out of 113 cross-protected acid limes planted in 1978, the percentage of survival was 22. In the case of unprotected seedlings grown in partial shade and open conditions it was found that survival rate was higher under partial shade conditions. The performance of seedlings in terms of vigour (height, girth and spread) showed that the cross protected seedlings excelled the unprotected ones in growth.

#### **Crop management**

##### *Varietal cum root stock trial in mandarin (Ambalavayal)*

The objective of the study was to find out the best root-stock/scion combinations for the agro-climatic conditions of Wynad. The experiment laid out in 1979 is in progress.

##### *Rootstock trial on coorg mandarin (Ambalavayal)*

The objective of the study was to find out the best root stock for coorg mandarin under Wynad conditions. The study indicated that the fruit characters—weight, volume, diameter, girth, pulp weight, rind weight and number of seed/fruit were high when mandarin orange was on rough lemon and *Carriza citrange*. The trial will be continued.

##### *Manurial trial on coorg mandarin (Ambalavayal)*

In order to arrive at an economic optimum manurial schedule for mandarin oranges under Wynad conditions, this experiment was laid out in 1976. Since the population of plants under trial was highly variable due to periodical gap filling, the project co-ordinator suggested modification of the technical programme. A new trial was laid out in 1980 with rough lemon as the rootstock. The different treatments will be given in 1981.

## **PAPAYA**

### **ONGOING PROJECTS**

#### **Crop improvement**

##### *Collection and evaluation of papaya types (Carica papaya) (Vellanikkara)*

Fruits of 52 types were collected and seeds extracted. The fruit characters such as weight, length, shape, flesh colour, flavour, taste, seediness and T. S. S. were recorded. The seeds were sown during Nov-Dec, 1980 and the seedlings transplanted to the mainfield during February '81 (33 types) and March, 81 (18 types).

## VEGETABLES AND TUBER CROPS

### VEGETABLES

#### CONCLUDED PROJECTS

##### Crop management

###### *Biometrical studies in ashgourd (Vellanikkara)*

The present study identified BH-21 as the promising line with the highest yield (2.01 kg), higher flesh thickness (6.61 cm) and protein content (8.12%).

###### *Phenotypic stability analysis in bhindi (Abelmoschus esculentus (L) Moench (Vellanikkara)*

Twenty five genotypes of bhindi consisting of released varieties and promising lines were grown continuously for two seasons in high yielding and low yielding environments within each season. The varieties Pusa Sawani, Lam selection, Hybrid selection 1 and Pusa Makhmali were observed as the stable genotypes. Pusa Sawani yielded 3.61 kg/10 plants compared to 3.75 kg in Lam selection, 3.57 kg in Hybrid selection 1 and 2.83 kg in Pusa Makhmali. The variety Pusa Sawani could be recommended for cultivation in all the environments.

###### *Studies on heterosis and combining ability with respect to important economic traits in chilli (Capsicum annum) (Vellayani)*

Two hybrid combinations Purple Round x Vellanotchi and Pant C-1 x Purple Cluster manifested desirable economic attributes. The above four parents were selected based on genetic divergence.

##### Plant protection

###### *Role of weeds in the perpetuation of virus diseases of vegetables and ornamental plants (Vellayani)*

Thirteen virus diseases affecting ten species of weeds were collected and studied. All the 13 viruses were transmitted by grafting. Eight viruses were transmitted by white flies.

Mosaic viruses of *Amaranthus viridis* were transmitted by aphids. Mosaic of *Amaranthus viridis* infected the cultivated species of amaranthus and *Celosia cristata*.

###### *Seed mycoflora of some vegetables in Kerala (Vellayani)*

A number of fungi were isolated from the seeds of the vegetables. The seed borne fungi were found to cause inhibitory effect on the germination of seeds. Maximum inhibition in the germination was found to be caused by *Aspergillus flavus*, *A. niger*, *Penicillium* sp. and *Rhizopus stolonifer*. The fungicide Thiride was found superior to other fungicides tested (Captan, Difolatan, Dithane Z-78, Aureo fungin sol, Barassicol, Dithane, Dithane M-45).

No significant difference was observed in the germination of vegetable seeds of amaranthus, bhindi, brinjal, bittergourd, cowpea, cucumber, snakegourd and tomato, stored in different containers namely cloth bag, paper bag, earthen pot, polythene bag, tin container, gunny bag, and other indigenous methods of storage, namely ash, saw dust sand and coconut pith.

#### *Control of root knot nematode in brinjal (Vellayani)*

The effect of nursery treatment with nematicides to control root knot nematode, *Meloidogyne incognita* in brinjal was studied. Nematode free seedlings of brinjal could be produced by nursery treatments with Carbofuran, Aldicarb and Metham Sodium. Maximum control of the root knot nematode in the main field was obtained by nursery treatment with Carbofuran @ 4 g/m<sup>2</sup> and Metham Sodium 25ml/m<sup>2</sup>.

### ONGOING PROJECTS

#### Crop improvement

##### *Evolving a high yielding variety of bhindi through hybridisation (Vellayani)*

Culture-5 was found to be better yielding (1.05 kg/1.62 m<sup>2</sup>) than Pusa Sawani (0.65 kg/1.62 m<sup>2</sup>) and Kilichundan (0.65 kg/1.62m<sup>2</sup>). Kilichundan and Pusa Sawani were the parents of Culture 5.

##### *Selection and breeding in bhindi (Mannuthy)*

The 14 types selected from 48 types were used for laying out the experiment. The type T-10 was observed superior (28.77 kg/30 plants) compared to 19.74 kg/30 plants in Pusa Sawani.

##### *Introduction of variability in Abelmoschus manihot var. ghana by irradiation (Vellanikkara)*

The seeds of *Abelmoschus manihot* var. ghana were irradiated with 10 kr, 15 kr, 20 kr of gamma radiation. The irradiated seeds were sown in Mo generation. They started flowering within 54 days after sowing. The flowers were selfed to raise M<sub>1</sub> generation. The earlier selfed flowers set fruits. But these fruits fell after 3-4 days of petal fall. A general increase in vigour was observed for irradiated plants as compared with control. The plants having purple tinge on stem and petiole set fruits. Light green plants did not set fruits. In seeds treated with 10 kr, no plant with green stem set fruits. Cytological studies with immature flower buds are in progress.

##### *Etiology, survival and control of bacterial wilt of brinjal, caused by Pseudomonas solanacearum (Vellayani)*

The pathogen was isolated and its pathogenicity established.

##### *Isolation and release of bacterial wilt resistant brinjal variety (Vellanikkara)*

The line Sm-6 was observed resistant to bacterial wilt under field conditions. The line has been entered in the AICVIP testing programme

on national basis. The laboratory tests to confirm resistance using different isolates of *Pseudomonas solanacearum* are in progress.

*Survey, collection and maintenance of germplasm in brinjal cucurbits and their wild relatives (Vellanikkara)*

Eighty three lines of brinjal, 41 lines of ashgourd, 72 lines of bittergourd, 12 lines of bottlegourd, 27 lines of snakegourd, four lines of round gourd, 28 lines of watermelon, 39 lines of pumpkin, 68 lines of cucumber and 17 lines of ridgegourd are maintained. In addition, eight related species of *Solanum melongena*, three of *Cucurbita moschata* two of *Momordica charantia* and two sp. of *Luffa* are also being maintained.

*Cataloguing of brinjal germplasm to isolate line (s) resistant to bacterial wilt (Vellanikkara)*

The experiment was started during June 1981, to catalogue the lines based on quantitative and qualitative characters.

*Screening brinjal genotypes for resistance to bacterial wilt disease (Vellayani)*

Twenty three brinjal genotypes obtained from earlier trials were subjected to artificial wilt inoculation. Five types were found to be completely free from bacterial wilt.

*Selection of superior types of Capsicum annum with economic attributes from segregating generations of intervarietal crosses (Vellanikkara)*

From the F<sub>3</sub> generations of G 4 x Pusa Jwala, Vellanotchi x Pusa Jwala and Pant C-1 x Purple Cluster, superior plants with economic fruits were selected. These plants would be further evaluated for yield potential and uniformity.

*Screening chilli cultivars against leaf curl complex and isolation of locally adopted high yielding resistant line (s) (Vellayani)*

Among seven varieties tried, the variety Blue recorded maximum yield (177.88 g/plant) and minimum infection (10%) to leaf curl complex.

*Response of chilli genotypes to Ethephon application (Vellanikkara)*

The Experiment was started in July 1981 to classify chilli genotypes to responsive/non responsive groups, to investigate into the reasons of responsiveness/non responsiveness and to find the morphological reasons for higher fruit yield resulting from growth regulator application.

*Inheritance of clusteriness, destalkness and deep red colour in chillies, (Capsicum annum) (Vellanikkara)*

Two lines in clustered types and two types in solitary types were isolated. They were selfed and crossed. Six F<sub>1</sub>s, 6 F<sub>2</sub>s, 6 BC<sub>1</sub>s and 6 BC<sub>2</sub>s

were evolved for further analysis. The results showed that solitary character was dominant over clusterness. Pendulous nature was dominant over erect fruit type.

*Breeding for polygenic resistance in chilli against leaf curl and mosaic complex (Vellanikkara)*

Thirty nine lines of chilli were collected during 1980-81. During 1979-80, selections were made in segregating populations of Jwala, Pant C-1, Pant C-2 and NP 46-A for longpods and resistance to leaf curl and mosaic. The lines are being grown for further selection and improvement.

*Collection, selection and evaluation of improved chilli varieties (Capsicum species) (Vellanikkara)*

The present possession of *Capsicum* germplasm is 26. The lines collected during 1980 consisted of Giant Bell, Long Sweet yellow, Picora, Bell pepper, Russian Yellow, Selam yellow, Pached yellow, Hot Portugal and California Wonder.

*Relative of effectiveness of hybrids and 50:50 physical mixtures to improve productivity and disease resistance in chilli ((Vellanikkara)*

Six divergent chilli varieties, Jwala, Pant C-1, G4, K-2, CA-36, and local Kandhari were used to develop 15  $F_1$  hybrids. The  $F_1$  hybrids their parents and fifteen 50:50 physical mixtures would be grown during two consecutive crop seasons to identify productive  $F_1$  hybrids/ physical mixtures with resistance to parasitic disease.

*Evolving high yielding tomato varieties with resistance to bacterial wilt (Vellanikkara)*

Five lines AC-99, AC-142, Pant T-3, Lal Mani and Local Gola were collected during 1981. These varieties are being tested for suitability under acidic soil conditions of Kerala. The line CL-32-D-O-1-19 GS has shown tolerance to bacterial wilt during the year under report. Attempts are being made to select plant type (s) which are large fruited and resistant to wilt.

*Genetic cataloguing of tomato germplasm towards isolation of line (s) resistant to bacterial wilt (Vellanikkara)*

Seventy eight lines collected from different sources were genetically catalogued. Field screening indicated the tolerance of one line LE-79 received from AVRDC, Taiwan. This line had indeterminate growth habit, green shouldered and medium sized fruits and the seeds were covered with yellow gel. The line was grown in the field continuously for six seasons to confirm the observed field resistance. The susceptibility ranged from 0% to 1.34% at the adult plant stage.



*Screening the germplasm collection for yield, quality and adaptability (Vellayani)*

Thirteen varieties of amaranthus were grown during 1980. The variety Erandankeera was found to be the best among the varieties tried (4.67 kg/plot).

*Screening for non-bolting types of amaranthus suited for year-round planting (Vellanikkara)*

The experiment was started during April 1981. Twenty five genotypes of amaranthus were raised at monthly intervals and observations on days to bolting, number of cuts, yield per cent, total yield, days to bolting after each cut etc. were recorded. Accession numbers A 6 (Kannara local) and A 33 (local deep red) were found to be non-bolting.

*Evaluation of hot weather cauliflower varieties suited for cultivation in Kerala State (Vellanikkara)*

Five lines 328-5-10-5-1, 351-4-1, 395-2, 424-2 and 327-14-8-3 were assessed for their suitability under Kerala conditions during Sept-January season. Curd formation was seen in all the lines. But curds were undersized and curd malformations like riceyness and fuzzines were observed.

*Breeding for long podded vegetable type of cowpea (Pattambi)*

There was no significant difference in yield among the varieties. Pusa Barsathi (10.53 t/ha), No. 5369 (10.21 t/ha) and Manjeri local (10.05 t/ha) were found to be the high yielders.

*Selection of suitable cucurbit varieties (Vellanikkara)*

The bitter gourd line MC-23 was found to yield 23.63 t/ha where as Co-1 yielded only 20.69 t/ha. It was included in the AICVIP and was tested in three centres during 1978-79 and 1978-80. Seeds were distributed to cultivators as per the multilocational testing programme.

The snake gourd line TA-19 was found to be superior during the previous year's trial and was also put under multilocation trials in farmer's fields.

*Trial with Ethephon, NAA and GA in bittergourd to increase production (Vellayani)*

Among the various treatments, all the doses of Ethrel (50,100 and 200 ppm), low and medium doses of NAA (50, 100 ppm) and low dose of GA (25 ppm) showed better effects with respect to yield. Vit.C content was high at the lower doses of the chemicals. Iron content was high at all doses of Ethrel, NAA and low dose of GA.

*Varietal trials in watermelon and cucumber (Vellanikkara)*

Sugar Baby was found to be the highest yielder (13 fruits/plot) among the 13 varieties tried. The TSS was high in Madhu hybrid (10.67) and Sugar Baby (10.33).

Among eight varieties of cucumber grown during March 1980 to January 1981, maximum-yield was recorded by CS-26 (14.58 kg/plant).

## Crop management

### *Studies on the effect of graded doses of N, P and K on growth, yield and quality of bhindi (Vellanikkara)*

The fertilizer trial conducted during 1978-79 revealed increased yields with increased levels of N, P and K. A bhindi crop yielding 116.39 q/ha removed 87.81 kg N, 20.57 kg  $P_2O_5$  and 109.3 kg  $K_2O$ /ha. The experiment was repeated during June-Sept 1980 in  $3^3$  factorial RBD with two replications. In the previous experiment, response to nitrogen was quadratic and response to P and K, linear. The economic and optimum levels of N were worked out to be 61.25 kg/ha and 61 kg/ha, respectively. Considering the linear response to P and K, the fertilizer doses were modified to N (40, 60, 80 kg/ha),  $P_2O_5$  (30, 60, 90 kg/ha) and  $K_2O$  (30, 60, 90 kg/ha). The application of nitrogen at 60 kg/ha, and  $P_2O_5$  60 kg/ha significantly increased the yield of okra. Response to K was not significant.

### *Studies on the effect of different levels of N, P and K on the yield of brinjal (Mannuthy)*

An experiment was laid out in  $3^3$  factorial RBD with two replications. Three levels each of N (0, 25, 50 kg/ha), P (0, 25, 50 kg/ha) and K (0, 25, 50 kg/ha) were tried.

### *Studies on the effect of graded doses of NPK on the yield and other agronomic characters of chillies (Vellanikkara)*

An experiment was laid out in  $3^3$  Factorial RBD with two replications. Three levels each of N (0, 20, 45 kg/ha), P (0, 20, 40 kg/ha) and K (0, 20, 40 kg/ha) were tried.

### *Effect of graded doses of NPK on bittergourd (Mannuthy)*

An experiment was laid out in  $3^3$  factorial RBD with two replications. Levels of N were 0, 25, 50 kg/ha, those of P-0, 25, 50 kg/ha and K-0, 25, 50 kg/ha. The highest yield of 7.225 t/ha was obtained at 50 kg N, 25 kg  $P_2O_5$  and 25 kg  $K_2O$ /ha.

### *Effect of graded doses of NPK on the growth, yield and quality characteristics of cucumber (Vellanikkara)*

Experiments were laid out during Sept-Dec, 1979, March-June, 1980 and Sept-Dec, 1980 in  $3^3$  factorial RBD with two replications. Factorial combinations of N (0, 25, 50 kg/ha),  $P_2O_5$  (0, 50, 200 kg/ha) and  $K_2O$  (0, 50, 200 kg/ha) were tried with the variety CS-26. The results indicated that there was no significant increase due to phosphorus application. Response to nitrogen was quadratic. An economic optimum dose of N was worked out as 46 kg/ha. Response to K was linear.

### *Studies on the effect of graded doses of NPK on the growth, yield and quality of pumpkin (Vellanikkara)*

Factorial combinations of three levels of N (0, 50, 100 kg/ha),  $P_2O_5$  (0, 50, 100 kg/ha) and  $K_2O$  (0, 25, 50 kg/ha) were tried. The results

indicated that optimum dose of nitrogen was 77 kg/ha, the economic dose being 71 kg/ha. The effect of P was linear, where as that of K was non-significant

### **Plant protection**

#### *Control of root-knot nematodes in brinjal-Trial with new chemicals (Vellayani)*

Dibutylamino Sulphuryl Carbofuran treated (9.3 ml/m<sup>2</sup>) plants gave the maximum yield (5.26 kg/plot) as against the control (3.03 kg/plot). At the end of the experiment, the untreated plot showed the maximum number of nematodes (173/100 g soil) while the population was 54.75 in the Phenamiphos plots (68.3% reduction).

#### *Studies on the effect of plant extracts and oils from plants on controlling pests of brinjal (Vellayani)*

Neem cake, lemongrass oil and cashew shell oil were found effective against leaf feeding insects.

#### *Integrated control of Meloidogyne incognita in brinjal (Vellayani)*

Maximum yield was obtained under nursery treatment with Metham sodium, normal ploughing and spot application of Aldicarb. The nematode population was significantly reduced by deep ploughing and Metham sodium nursery treatment.

#### *Control of root-knot nematodes in brinjal-Trial with new chemicals (Vellayani)*

Phenamiphos 0.3 g/m<sup>2</sup> and Metham sodium 25 ml/m<sup>2</sup> gave maximum control of root-knot nematode on brinjal. Highest yield was obtained in Dibutylamino Sulphuryl Carbofuran treated plots.

#### *Chemical control of brinjal shoot and fruit borer in relation to population and terminal residues on fruits (Vellayani)*

Three pyrethroids were evaluated against the pest and they gave good control over the borer only for two weeks. Cypermethrin was found to be the best.

#### *Seed treatment with nematicides and fungicides for the control of root-knot nematode (M. incognita) in bhindi (Vellayani)*

Carbofuran+Thiram treatment followed by Aldoxycarb treatment gave effective control of the nematode population (88.6% & 85.5% reduction over the control). Maximum yield was obtained in treatment with Aldoxycarb+Captofoil (64.7% over check), followed by Carbofuran treatment (2.6% increase).

#### *Control of root-knot nematode on bhindi using newer granular nematicides (Vellayani)*

The yield of bhindi was maximum and nematode minimum in Aldicarb treated plots.

### *Integrated control of nematode pests of bhindi with special reference to root-knot nematode*

The studies indicated that deep ploughing by itself was effective in reducing galling of the roots by the nematode and increased the yield by 33%. Treatment of soil with Aldicarb gave significant reduction of nematode infestation and increased yield to the extent of 50 to 69%. Seed treatment was effective in reducing nematode infestation and increased the yield (35 to 55%). Combinations of Aldicarb and seed treatment also were highly effective in suppressing nematode infestation and increasing the yield (46 to 59%). In all the treatments, those receiving deep ploughing gave added effect. The improved variety AE 112 was significantly less susceptible than the five local varieties tested.

### *Control of the fruit fly, *Dacus cucurbitae*, of snakegourd*

The project aims at evolving an effective method for controlling snake ground fruitfly by minimising the insecticidal application.

## **TUBER CROPS**

### **CONCLUDED PROJECTS**

#### **Crop improvement**

#### *Genetic studies in sweet potato, (*Ipomoea batatas*-a biometric approach) (Vellayani)*

Forty varieties of sweet potato collected in 1974 were assessed for genetic divergence, path analysis, heritability, combining ability and heterosis. Heterosis was observed for vine number and tuber characters. Culture H-2752 and H-2712 satisfied all the three stability parameters for yield. Specific adaptation to favourable environment was shown by H-2412, H-2416, H-2421, H-2742, H-2743, H-3802 and H-4021.

#### **Plant protection**

#### *Control of sweet potato weevil and other important pests of sweet potato (Vellayani)*

Among the organic materials tried, callophyllum cake gave significant control, followed by lemongrass leaves and mahwa cake. Cashew shell powder and neem cake were ineffective. Fenitrothion followed by Fenithion applied twice at monthly intervals gave the best control.

#### *Survey of the population of white fly, *Bemisia tabacci* and spread of cassava mosaic disease (Ambalavayal)*

The peak load of vector population was seen only when the crop attained maturity. There was no primary infection nor was there any secondary spread of tapioca mosaic.

### **ONGOING PROEJCTS**

#### **Crop improvement**

#### *Comparative yield trial of progenies of *Malavella* x $M_4$ (Ambalavayal)*

Nine progenies of the cross *Malavella* x  $M_4$  were grown along

with H 1323, H 2304, Malavella,  $M_4$  and H 1687. The hybrids did not yield significantly higher than their parents.

*Uniform regional trial on tapioca (Vellanikkara)*

The varieties H 312 and H 2304 recorded the highest yield (20.45 t/ha and 23.92 t/ha, respectively).

*Initial evaluation trial of sweet potato (Vellanikkara)*

Nineteen cultivars of sweet potato were included in the trial which was laid out in RBD with three replications and adopting a plot size of 3.6 m x 4.2m. The varieties 76-OP 219 and 76-OP 217 showed promising results (12.04 t/ha and 14.49 t/ha, respectively).

*Evaluation of high yielding varieties of sweet potato (Vellayani)*

Culture 4021 yielded the highest among the seven hybrid cultures and one local variety, when grown at the Instructional Farm, Mannuthy. A detailed multilocational trial is proposed in seven Research Stations of the University.

*Evaluation of high yielding varieties of sweet potato (Vellayani)*

Eight sweet potato varieties were grown in RBD with three replications. H 4126 recorded the highest yield (28.5 kg/13.5 m<sup>2</sup>) followed by Chindamony (23.0 kg/13.5m<sup>2</sup>) and H 4021 (22.16kg/13.5m<sup>2</sup>). The three varieties however were statistically on par.

*Uniform regional trial of sweet potato (Vellanikkara)*

The highest marketable tuber yield (25.98 t/ha) was recorded by the variety C-71, followed by OP-2 (23.16 t/ha). The vine growth was maximum in Kanghangad local. The extent of weevil damage was less in H 620 and Kanghangad local.

*Uniform regional trial of Dioscorea esculenta (Vellanikkara)*

The experiment was conducted with the objective of identifying the most promising variety suited to the agroclimatic conditions of Trichur. The varieties tried were De-11, De-17, De-23, Lothane and Chparia. The varieties were on par with respect to tuber yield.

*Uniform regional trial on Dioscorea alata (Vellanikkara)*

The experiment was designed to identify the most promising variety of *Dioscorea alata* suited to agroclimatic conditions of Trichur. The varieties used were Da-42, Da-48, Da-60, Da-80 and Da-122. The variety Da-41 gave maximum yield.

**Crop management**

*Effect of different irrigation schedules on growth and quality of tapioca (based on IW/CPE ratio) (Chalakudy)*

Giving supplemental irrigation during the dry periods benefitted the October-planted tapioca both at nine months and 11 months maturity, increasing tuber yield to the extent of 46 to 68%. The optimum

irrigation schedule for tapioca crop harvested either at nine months or 11 months maturity was 5 cm irrigation at an IW/CPE=0.5, requiring a mean irrigation interval of 24 days. The supplemental irrigation to tapioca enabled the earlier harvest of the crop at 9th month, thereby releasing the land for a short crop of rice or any other crop of farmer's choice. Irrigated crop of tapioca harvested at the 11th month produced an additional tuber yield of 4-5 t/ha over the irrigated crop harvested at the 9th month.

#### *Studies on the water requirement of tapioca in intercropping systems (Chalakkudy)*

An experiment was laid out in RBD with two replications to work out the increase in water use efficiency from subsidiary crops other than tapioca and to work out an optimum irrigation schedule for tapioca based intercropping system.

Growing intercrop of cowpea, greengram, blackgram or groundnut did not affect the yield of the main crop (tapioca). At the same time, intercropping gave an additional yield of 769 kg/ha as pods in groundnut, 876, 595 and 847 kg/ha as grain in cowpea, greengram and blackgram, respectively. The treatment  $W_1$  (IW/CPE=0.3) was the most suitable irrigation schedule for tapioca when grown either as a pure crop or when intercropped with cowpea, greengram, blackgram or groundnut. The maximum receipt of Rs. 13648 was recorded when tapioca was intercropped with blackgram. But it was on par with tapioca intercropped with groundnut, greengram or cowpea.

#### *Fertilizer trial on tapioca*

Treatments consisted of factorial combinations of four levels of N (0,30,60,90 kg/ha) and four levels of K (0,30,60,90 kg/ha). There was no significant effect of the application of higher levels of fertilizers. The experiment would be repeated.

#### *Fertilizer trial on tapioca (Vellanikkara)*

A fertilizer trial was conducted with four levels of N (0,60,120,180 kg/ha) and four levels of K (0,60,120,180 kg/ha). The varieties used were local and H 1687. The highest yield of 19.91 t/ha was obtained with 180 kg N/ha & 180 kg  $K_2O$ /ha. The hybrid variety produced significantly higher yield at all fertility levels compared to the control.

#### *Studies on stages of harvest of tapioca (Vellanikkara)*

One local variety and one hybrid were used in the study. The drymatter content in tubers was found to be less when the crop was harvested at six months stage.

#### *Intercropping trial on tapioca (Vellanikkara)*

The intercrops used were groundnut, cowpea, greengram, blackgram and soybean. There was one treatment without any intercrop.  $M_1$  variety was used. The results showed that groundnut, blackgram and

cowpea were ideal intercrops for tapioca. The yield from these intercrops was 879, 538 and 572 kg/ha, respectively.

*Fertilizer trial on sweet potato (Vellanikkara)*

Factorial combinations of three levels of nitrogen (30,60, 90 kg/ha) and  $K_2O$  (30,60 and 90 kg/ha) and an absolute control were compared. There was no significant effect for the application of higher levels of nitrogen and potash.

*Studies on the effect of Cycocel (Vellanikkara)*

The aim of the experiment was to study the effect of different concentrations of Cycocel (500, 1000, 1500 and 2000 ppm) on the vegetative growth and yield of sweet potato. The treatment effects were not significant.

*Studies on the two-tier cropping in sweet potato (Vellanikkara)*

Objective of the experiment was to study the possibility of increasing the production of sweet potato by exploiting the different layers of soil, utilizing the shallow rooted and deep rooted varieties. Two-tier cropping resulted in higher yield and was superior to other treatments.

*Studies on the stage of harvest of sweet potato (Vellanikkara)*

Most of the varieties recorded high marketable tuber yield when harvested between 90 and 105 days after planting. C-71 was found to be an early variety.

*Studies on the economisation of planting material in elephant foot yam (Vellanikkara)*

The highest yield of 40121 kg/ha was produced by planting bits weighing 1.0 kg. This was on par with bits of 750 g combined with fy m and urea. The smallest bit ( $\frac{1}{4}$  kg) produced the lowest yield at all manurial levels.

*Effect of graded doses of N and K on the growth and yield of clocassia var. Thamarakkannan (Vellanikkara)*

Factorial combinations of three levels of N (40,80 and 120 kg N/ha) and K (40, 80, 120 kg  $K_2O$ /ha) were compared. The effect of higher levels of N and K on tuber yield were not significant.

*Evaluation of drip irrigation system for vegetables (Chalakudy)*

Basin and drip methods of irrigation with 3 cm. water at IW/CPE ratio of 0.4 were found to be equally suitable for cucumber. By adopting drip irrigation, considerable quantity of water can be saved which otherwise would have been lost in conveyance (in surface method).

Basin method of irrigation with 3 cm. water at IW/CPE ratio of 0.4 was found to be the best water management practice for bitter gourd. Basin method recorded significant yield increase over the drip method.

## **Plant protection**

### *Symptomatological and histopathological investigations on the cassava mosaic disease (Vellayani)*

The main objectives of the project is to study the symptomatology, histopathology and electron microscopy of the causal agent, transmission by mechanical means & insect vectors and mode of spread of the disease. The disease was found to be graft transmissible. Studies on transmission by mechanical means and insect vectors did not yield fruitful results. Work on screening local as well as hybrid varieties of tapioca for their relative tolerance/resistance is in progress.

## **PULSES & OIL SEEDS**

### **PULSES**

#### **CONCLUDED PROJECTS**

##### **Crop improvement**

##### *Induction of mutation in cowpea (Vellayani)*

Cowpea seeds were irradiated with gamma rays and treated with Ethyl Methane Sulphonate. Detailed studies were made on the M1 and M2 effect. Viable mutations affecting growth, flowering, duration flower and seed colour were identified in the M2. The grain colour mutants, dwarf types, early maturing types and erect types are being maintained. The selected desirable types will be multiplied and subjected to detailed evaluation for identifying the desirable ones.

##### *Varietal trial on black gram (Kayamkulam)*

The results of the trial indicated the variety Co-2 as suitable for Onattukara rice fields during the third crop season.

##### *Quantitative genetic study of yield and its components in blackgram (Vellayani)*

Quantitative genetic studies on yield and its components were conducted during 1977-80. Based on D<sup>2</sup> analysis, the 56 varieties of blackgram were grouped into 13 genetic clusters. High estimates of heritability were observed for days to flowering, maturity and 100 seed weight. Path coefficient analysis revealed that number of pods/plant, plant height, number of seeds/pod, number of primary branches/plant, 100 seed weight and days to maturity had direct positive correlation with seed yield. Pronounced heterotic effects were observed for pod and seed yield, early flowering and maturity. Additive gene action was indicated for most of the contributing characters. Variety NP-15 was the best combiner for the yield components and methionene content. Variety having a medium duration, tall stature with less number of branches would be a desirable plant type in blackgram. The genetic diversity and high heritability estimates for the yield contributing characters indicate good scope for selection and combination breeding programmes.



*Estimates of genetic parameters in green gram (Phaseolus aureus Roxb) Vellayani*

A quantitative study on the estimation of genetic parameters in greengram was conducted during 1978–80. The genetic coefficient of variation was maximum for number of branches per plant followed by hundred seed weight and minimum for days to 50 percent flowering. High heritability estimates were observed for pod length, 100-seed weight, plant height, number of seeds per pod, days to 50 percent flowering and number of pods per plant. Genetic gain was maximum for number of branches per plant, followed by 100 seed weight and minimum for days to 50% flowering. Additive gene action was indicated for number of branches per plant, 100 seed weight, number of pods per plant and pod length. Path coefficient analysis projected number of pods per plant and 100 seed weight as the traits exerting significant positive direct effect on yield. These characters should be given due consideration in selection programmes.

*Selection index in horsegram (Dolichos biflorus, L) (Vellayani)*

A biometric analysis of fifteen varieties of horsegram was conducted during 1978–80. Nine characters including yield were studied and 'Pattambi local' appeared to be the best, considering number of seeds per pod, number of branches and seed yield. Pod length exhibited maximum genotypic correlation with seed yield indicating that this character should be given maximum importance during selection for seed yield. Discriminant function analysis revealed that the index based on yield with number of seeds per pod and another based on yield with pod length were equal in effect and more advantageous than all others. Pod length exhibited maximum direct effect on seed yield.

*Mutation breeding in horsegram, Dolichos biflorus L (Vellayani)*

Studies were undertaken on the effect of five doses of gamma rays (10 to 50 K rad) and six doses of EMS (0.15 to 0.90 per cent) in Co1 variety of horsegram in the M1 and M2 generations. While gamma rays showed a stimulatory effect on germination, there was a corresponding decrease in EMS treatments on the percentage of germination with increase in dose. Both the mutagens showed reduction in the survival percentage, plant height and pollen fertility. Chlorophyll chimeras and morphological variations were observed in the M1 with both mutagens. In M2, the chlorophyll mutation frequency estimated on M1 progeny row and M2 seedling basis showed dose-dependence. EMS induced a wider spectrum and a higher segregation ratio of chlorophyll mutants than gamma irradiation. The frequency of viable mutants showed a similar trend with both the mutagens. The mutagenic effectiveness in inducing chlorophyll mutations was high at the lowest dose of both mutagens. On the basis of lethality and injury, 20 K rad was the most efficient. On

the basis of sterility, 10 K rad was most efficient. With EMS treatments, 0.15, 0.30, and 0.45 per cent were the most efficient on the basis of lethality, injury and sterility, respectively.

### **Crop management**

#### *Comparative study of the yield performance of different pulse varieties by altering the sowing season (Kayamkulam)*

Monthly sowing of nine varieties of cowpea was conducted during 1977 in the garden land. Sowing cowpea in July, June and August gave maximum yield in garden land.

#### *Physiological basis of growth and yield of three varieties of greengram (*Vigna radiata* (L) Wilezck) (Vellayani)*

It was found from this study that plant height, number of pods per plant, length of pod, NAR and RGR influenced the growth and yield in greengram. It is suggested that selection for high yield in this crop should be based on number of branches, number of pods/plant and length of pods.

#### *Effect of growth regulators on growth and yield of greengram (Vellayani)*

The study was conducted during 1979-80. GA was found to influence favourably the height of plants, number of branches, pods/inflorescence, fresh weight and dry weight of plants, LAI, LAD, NAR, nitrogen content of plants, protein content of grains, grain yield and harvest index. The highest level of NAA (100 ppm) was least effective in increasing the number of branches, inflorescences, pods per inflorescence, NAR and dry weight of plants. IAA, NAA and GA showed similarity in increasing significantly the protein content of grains. NAA at 25 ppm gave the maximum per hectare increase in net profit (54.40 per cent), followed by 25 ppm IAA.

### **Plant protection**

#### *Relative susceptibility of different varieties of pulses to infestation by the pulse beetle (*Moncompu*)*

Five cultures of pulses viz. K-39, Pusa-3, Kanakamani, C.M.11 and V-16 suffered only less than 3% damage in 30 days of storage. In sixty days of storage, most varieties suffered above 25% damage and in 150 days all the 25 varieties tested suffered 100% damage. Kanakamani showed the least damage when compared to other varieties.

### **ONGOING PROJECTS**

#### **Crop Improvement**

##### *Germplasm maintenance of different pulse crops (Pattambi)*

During the year, 760 cowpea varieties, 53 greengram varieties, 24 blackgram varieties, 15 horsegram varieties and 10 redgram varieties were maintained.

*Cowpea co-ordinated varietal trial (Pattambi)*

The varieties showed significant difference in yield. Out of the 16 varieties tried, the variety V-26 recorded the highest grain yield (1152 kg/ha) followed by V.240 (1139 kg/ha) and V.87 (1050 kg/ha).

*Early arhar co-ordinated trial (Pattambi)*

There was no significant difference in yield between varieties. However, the variety H77-208 recorded the maximum yield of 1750kg/ha, followed by DL. 78-1 with 1540 kg/ha and H 76-19 with 1453 kg/ha.

*Breeding high yielding cowpea varieties with short flowering phase (Pattambi)*

There was no significant difference in yield between varieties. However, the highest yield (144.23 kg/ha) was recorded by Culture-18. followed by Culture-17 (120 kg/ha). Flowering duration was also earlier than parents and the check varieties.

*Screening elite cowpea varieties for local adaptability and high grain yield potential (Pattambi)*

The variety V-16 recorded the highest yield which was on par with that of V-37 and was significantly superior to that of all other varieties.

*Breeding for long podded vegetable type of cowpea (Pattambi)*

There was no significant difference in yield between varieties. But among the 12 varieties tested, Pusa Barsathi (10526 kg of green pods per hectare), No. 5269 (10213 kg/ha) and Manjeri local (10046 kg/ha) were found to be high yielders.

*Investigations in intervarietal  $F_2$  hybrids in cowpea (Vellanikkara)*

Observations on 16 economic characters were recorded from all the available  $F_2$  plants belonging to 32 families representing 16 inter-varietal crosses in cowpea. A polygenic nature of inheritance was observed for most of the characters. It is possible to isolate superior genotypes by selection in the segregating population.

*Screening cowpea genotypes suitable for mixed cropping with tapioca*

Among the seven cowpea varieties tried, C. 152 was found to be significantly superior to the other varieties. The other varieties found suitable for mixed cropping with tapioca were Pusa-3 and HG-22.

*Cowpea co-ordinated varietal trial-II*

The trial conducted in the kharif season with six cowpea varieties revealed that No. 533 received from Karnal was significantly superior to N.551, C.152 and Ptb-1. No.533 recorded a grain yield of 850 kg/ha.

Another trial with ten cowpea varieties was laid out in the summer season. Though the yield difference due to varieties was not significantly different, No. 522 recorded the highest grain yield of 1309kg/ha.

*Evaluation of yield potential of locally adapted varieties of greengram (Pattambi)*

The varieties showed significant difference in yield. The varieties P. S. 10 (1021 kg/ha), N. P. 40 (861kg/ha) and N. P. 36 (837kg/ha) were found to be the high yielders

*Diallel analysis in greengram (Vellayani)*

On the basis of D<sup>3</sup> analysis, 15 varieties of greengram were grouped into five clusters. From each cluster, one variety was selected and these were used as parents for the analysis. Hybridisation was done in all possible combinations. F<sub>1</sub> was raised on the field and observations were made.

*Screening high yielding, short duration, drought tolerant blackgram varieties suited to second crop rice fallows*

The varieties Velloor T9 and MKU-3 were found to be the highest yielders among the 18 varieties tested.

*Evaluation of high yielding short duration varieties of blackgram through intervarietal hybridisation (Vellayani)*

Seven hybrid lines selected from different cross combinations were tested in F<sub>3</sub>. Selection of best plants on each line was done on the basis of plant height, number of inflorescences per plant, number of branches and number pods per plant. The seeds of the selected plants have been raised.

*Breeding horsegram varieties suited to the locality by single plant selection (Pattambi)*

Seventy two single plants were selected from the bulk and sown in progeny rows during 1979-80. From these progeny rows, 200 single plants were selected depending upon the weight of the grains per plant. Thirty two plants having more than four grams of grain weight were sown in progeny rows during 1980-81 rabi season. From these 32 rows, 52 single plants were selected for further studies.

**Crop management**

*Studies on the effect of pulses in summer rice fallows on the fertilizer N requirement of kharif rice (Pattambi)*

Among the different pulse crops, cowpea showed the highest soil enrichment capacity. Among the different levels of N, the plots which received N @ 90 kg/ha were significantly superior to others. Among the different levels of N under pulse crops, application of 30 kg N/ha, where cowpea was the summer pulse crop, recorded significantly higher grain yield and further addition of N resulted in a decrease in yield.

*Study on the effect of foliar spray of urea and diammonium phosphate on cowpea (Pattambi)*

Application of half the dose of nitrogen (10 kg/ha) and full dose of phosphorus (30 kg/ha) as basal and two foliar sprays of two percent solution of urea, at 20 and 30 days after sowing recorded the highest grain yield which was significantly superior to that in other treatments.

*Study on the effect of different phosphatic fertilizers and their method of application on the growth and yield of cowpea (Pattambi)*

Highest grain yield of cowpea was obtained when  $P_2O_5$  was applied at 37.5 kg/ha which was significantly superior to other treatments. Regarding sources and methods of application of phosphorus, superphosphate was found to be a better source than rock phosphate and placement of phosphatic fertilizer was effective than broadcasting.

*Methods to increase the efficiency of seed treatment with rhizobium in cowpea (Vellayani)*

Seed treatment with rhizobial culture + lime pelleting gave maximum grain yield (10q/ha), as against the lowest yield of 7.0q/ha by using the seeds with jaggery solution coating and 7.1q/ha. with control.

*Response of cowpea to water management practices and phosphorus nutrition (Chalaky)*

The main aim of experiment was to find out the effect of timing and frequency of irrigation on the growth and yield of cowpea and to determine the effect of P under different water management conditions and to study interaction between irrigation and P nutrition in cowpea. The field experiment has been completed and the data collected on growth and yield characters are being analysed.

*Nitrogen management in grain cowpea (Vellayani)*

The main objectives of the experiment were to find out the effect of soil + foliar application of nitrogen at later stages of crop growth with inoculation of efficient strains of rhizobium, to investigate the possibility of meeting the higher nitrogen demand at the stage of grain formation with supplemental doses of nitrogen and to work out the economics of cowpea grain production under different nitrogen management conditions. The field work has been completed. Observations on growth, yield and yield characters are being statistically analysed.

*Phosphorus nutrition of cowpea (Pattambi)*

The experiment was laid out to study the effect of different levels of  $P_2O_5$  and to evaluate the efficiency of different sources of phosphorus and different methods of application. The field work has been completed and data collected on growth characters, yield attributes and yield are being analysed.

#### *Studies on the factors of production in cowpea (Pattambi)*

Yield obtained from plots receiving "full package of practices" was on par with the treatments receiving "full package of practices, minus fertilizer and seed inoculation", "irrigation" and "plant protection". These four treatments were significantly superior to the "farmers' practice", "farmers' practice + improved seed," and "full package of practices minus weeding".

#### *Seed storage studies on pulses—Evaluation of different containers for storing cowpea seeds under Kerala conditions (Pattambi)*

Seeds of cowpea variety Kanakamoni was stored in ten different containers to find out the relative efficiency of them.

#### *Manural trial on blackgram (Kayamkulam)*

During 80-81, maximum yield (964 kg/ha) was recorded by treatment NPK 20-30-30 followed by NPK 30-40-20 (870 kg/ha).

During 1979-80, maximum yield was recorded by NPK-20-50-40 followed by NPK 30-30-40. The experiment will be concluded, after getting the results of pooled analysis.

#### *Scheduling irrigation for pulses—Blackgram (Chalakudy)*

The results indicated that the yield of grain did not significantly differ due to varieties, whereas the water management treatments exerted significant influence. Irrigation schedule of 3 cm during the first 25 days and 4 cms at IW/CPE=0.75 (irrigation interval being nine days) thereafter recorded the highest grain yield and was on par with IW/CPE=0.5. The results of 1979-80 had shown that irrigation schedule at IW/CPE=0.75 was significantly superior to all other treatments.

#### *Effect of different methods of irrigation and cultural practices on the growth and yield of blackgram (Chalakudy)*

Out of the two methods of irrigation tried, bed method was superior to the border strip method and recorded an increase in yield of 35.5%. All the three cultural practices tested significantly increased the grain yield as compared to "no interculture" treatment. Though not statistically significant, Toke E 25 recorded the highest grain yield. However, one interculture with hoe or one hand weeding would be most economical.

#### *Manurial trial on horsegram (Mannuthy)*

For Co 1 variety of horsegram, application of P at the rate of 28.37kg/ha produced the maximum yield. However, the application of N and K did not show any significant influence on the yield of horsegram under Mannuthy conditions.

#### *Studies on the effect of sowing densities and P levels on the growth and yield of horsegram (Pattambi)*

The effect of treatments due to different levels of phosphorus and spacings were not statistically significant.

## Plant protection

### *Screening cowpea varieties for resistance against collar rot and web blight disease of cowpea (Vellyani)*

Two isolates of *Rhizoctonia solani* were made, one from rice and another from cowpea. The pathogen was mass cultured in sand-maize medium and used for inoculation. Ten varieties of cowpea were collected and inoculated with the organism. None of the varieties tested was found to be resistant to the pathogen.

### *Studies on the collar rot and web blight of cowpea (Vellayani)*

The organism has been isolated and its genetic relationships has been tested with other isolates of *R. solani*. Host range studies done so far indicated that the pathogen could infect about 30 different host plants.

### *Studies on Rhizobium- selection of suitable strains for blackgram and greengram in Kerala (Vellayani)*

Eighteen Rhizobial strains from different agroclimatic regions of Kerala were isolated and purified. These strains were screened for blackgram and greengram and the promising strains were selected. The effect of two fungicides (PCNB and Thiride) on nodulation and nitrogen fixation in blackgram and greengram were tested. The techniques for the study on survival of *Rhizobium* in locally available carrier materials are also being standardised.

### *Control of storage pests of gram seeds (Vellayani)*

Maxing seeds with contact insecticide emulsions showed that Phoxim at 10 ppm and Etrimphos at 10 ppm were effective, giving protection upto two months. In another experiment conducted to evaluate the efficacy, it was shown that Phoxim at 10 ppm and 15 ppm were effective in controlling the pests up to four months after treatment. The studies on the effect of insecticide dusts and systemic insecticides are being continued.

### *Control of pulse beetle (Vellanikkara)*

There was no significant difference between the various treatments tried. However, with the passage of time, there was no increase in the infestation and a gradual increase in the germination percentage of the seeds was observed.

## OIL SEEDS

### SESAMUM

#### CONCLUDED PROJECTS

##### Crop improvement

##### *Initial evaluation trial of hybrid cultures of sesamum and district trial of hybrid cultures of sesamum (Kayamkulam)*

Performance of fifteen high yielding hybrid cultures of sesamum of the cross Pt. 58—35 x Kayamkulam—1 was studied in a C. Y. T. for three years from 1977 with a view to evolving a high yielding hybrid sesamum. Maximum yield of 636 kg/ha was recorded by Cul. No.8, followed by Cul. No. 7-1 with an yield of 634 kg/ha. Multilocal trial was conducted at five different locations with the above two cultures and the standard variety, Kayamkulam-1. Cul-8 was found significantly superior with an yield of 509 kg/ha in the multilocation trial. The oil content was 55.5%. The cul. 8 was released by name 'Thilothama' (Kayamkulam-2) by the Kerala Agricultural University during 1980.

##### *Genetic analysis of pod characters in sesamum (Vellayani)*

Genetic analysis of multipoded and multiloculed characters was undertaken. Cyclic crosses between six multipoded varieties indicated that two independent gene loci govern this character. Similarly, cyclic crosses between four multiloculed varieties indicated that two independent gene loci govern this character also. The hybrid between multipoded and multiloculed varieties was normal. The  $F_2$  analysis revealed that the two pod characters assort independent of each other indicating the possibility of recombining them in a single genotype.

#### ONGOING PROJECTS

##### Crop improvement

##### *Varietal improvement on sesamum (Kayamkulam)*

Under the programme for collection and maintenance of available varieties of sesamum for evolving high yielding varieties, 44 varieties true-to-the-type were maintained during the 3rd crop season in the rice fallows. During 1979-'80, fifty five varieties were maintained under the germplasm collection.

##### *C. Y. T. of promising sesamum varieties (Kayamkulam)*

To study the performance of eight selected varieties of sesamum as compared to Kayamkulam-1, a C. Y. T. was conducted from 1979 third crop onwards. During 1980-81, maximum yield was recorded by IS-614 (641 kg/ha) followed by No. 42, Kayamkulam-1 and KRR-2. During 1979-80, maximum yield was recorded by KRR-2 (493 kg/ha) followed by No. 42 (477 kg/ha).



### *Cytogenetic studies on inter-varietal hybrids of sesamum (Sesamum indicum) (Vellayani)*

Crossing work was carried out using seven selected varieties and the  $F_1$ 's of twenty three crosses were raised. Observations were recorded during the year.

### *Evaluation of the productivity of selected sesamum genotypes (Vellayani)*

Observational trial with 15 selected genotypes was conducted during May-August, 1980. Detailed morphological description of different genotypes was made. The trial for evaluating the productivity of all the types was started under upland conditions at Vellayani and observations were made for 14 characters. P 28 (2) and No.42 seemed to be promising. The trial for evaluating the productivity under wet-land conditions at Kayamkulam was started and observations were recorded.

### *Induced mutations in sesamum (Vellayani)*

X- and gamma irradiated  $M_2$  generation was raised and the viable mutants scored. Seeds were treated with six different doses of EMS and the  $M_1$  generation raised. The  $M_2$  generation was also raised. In combination treatment, the seeds were treated with different doses of gamma rays and EMS and the  $M_1$  generation raised. Under recurrent treatment, the seeds collected from  $M_1$  plants of different doses were again treated with gamma rays and raised. Observations on lethality, injury and sterility were recorded. The chlorophyll and viable mutants were also scored. Forty four varieties were collected and maintained for the study of varietal sensitivity to radiations.

### **Crop management**

#### *Effect of potash on the yield and oil content of sesamum (Kayamkulam)*

Maximum yield 285/ha was recorded by T6 (30:15:30 basal + 30 kg  $K_2O$ /ha at interculture), followed by T4 (30:15:30 basal + 20 kg  $K_2O$ /ha at interculture) with 257 kg/ha. During 1979-80, maximum grain yield 359 kg/ha was recorded by T<sub>2</sub> (30:15:15 basal) followed by T5 (15 kg  $K_2O$ /ha at interculture) with 351 kg/ha.

#### *Fertilizer management practices for the multipoded mutant of Kayamkulam-1 (Kayamkulam)*

To study the effect of different management practices on the yield of multipoded mutant of Kayamkulam-1, a trial was conducted from 1979 onwards. During 1980-81, maximum yield (367 kg/ha) was recorded by T3 V2 (NPK 15:15:15 basal with cattle manure 5 tons/ha + NPK 15:0:5 at interculture), followed by T4 V2 (NPK 30:15:30 + 15:0:15 at interculture) with 304 kg/ha (15-0-5). During the previous year also, maximum yield was recorded by T3 V2.

*To evolve suitable agronomic methods to obtain uniform population and maximum yield in the bulk crop of sesamum (Kayamkulam)*

During 1980-81, maximum yield (234 kg/ha) was recorded by treatment No. 1, (sowing and then ploughing) followed by T3 (208 kg/ha) and T4 (200 kg/ha).

*Weedicidal trial on sesamum (Kayamkulam)*

Maximum yield (687 kg/ha) was recorded by T-2 (weedicide Alachlor 0.50 kg/ha), followed by T1 (Alachlor 0.25 kg/ha) with 675 kg/ha and T<sub>3</sub> (Alachlor 0.75 kg/ha) with 675 kg/ha. Weed count was less in hand weeded plots.

*Storage trial in sesamum (Kayamkulam)*

The effect of different conditions of storage on the viability and germination of sesamum seeds was studied. The results indicated that in all cases T6 (storing in tin mixed with ash) recorded the lowest germination ranging from 40.00 to 96.33%.

*Effect of potassium, magnesium and sulphur on the yield and quality of sesamum (Kayamkulam)*

The main aim of the experiment was to study the effect of K, Mg and S on the yield and quality of sesamum. The field experiment has been completed.

*Evolving suitable agro-techniques for sesamum in Onattukara (Kayamkulam)*

This experiment was conducted to arrive at suitable preparatory cultivation practices and best method of sowing for sesamum in Onattukara tract and to find out suitable sowing time for sesamum. The field work has been completed.

**Plant protection**

*Investigation on diseases of sesamum (Kayamkulam)*

The trial was started from 1979. During 1980-81, phyllody and powdery mildew were observed in the later stages of the crop. There was no appreciable reduction in yield due to the infection of the disease.

*Studies on the pests of sesamum and their control (Kayamkulam)*

Extent of damage by insect pests were studied during third crop season. During the early stages, aphid attack was observed. But during the later stages, stem and pod border attack was severe. In the pre-flowering and post-flowering stages, leaf roller was severe in late sown crop affecting the yield.

## GROUNDNUT

### ONGOING PROJECTS

#### Crop management

##### *Adaptive trials of improved varieties of annual oil seed crops in Kerala (Mannuthy)*

Ninetyfive varieties of groundnut have been collected from various sources such as NBPGR-Regional Centre (Vellanikkara), Tamil Nadu Agricultural University, University of Agricultural Sciences (Bangalore), BARC, ICRISAT, Punjab Agricultural University etc. They were sown on 31-1-81 in rice fallows. Two varieties failed to germinate. The remaining varieties came up satisfactorily. The different varieties including the recommended varieties TMV-2,7,9 and Pollachi-1 showed great variability in growth habit, vigour, morphological and agronomical traits.

##### *Varietal trial on groundnut (Kayamkulam)*

A varietal trial on groundnut was conducted to study the performance of different groundnut varieties in rice fallows in Onattukara, during January-April months. The experiment was conducted for three seasons from 1978. The results indicated that maximum pod yield was recorded by the variety TMV-2. The variety was found to be suitable for cultivation in Onattukara rice fallows (duration of 100-105 days). Short duration varieties (90-95 days) of groundnut will be more suitable for cultivation in Onattukara rice fallows. Hence, the trial will be continued with short duration varieties.

##### *Breeding groundnut varieties suited to different agroclimatic conditions in Kerala (Vellayani/Mannuthy)*

Eighty eight varieties of groundnut were collected from different sources such as NBPGR-Regional Centre (Vellanikkara), Tamil Nadu Agricultural University, University of Agrl. Sciences (Bangalore), Gujarat Agrl. University, BARC, etc. These were planted in uplands during June 1980 at Vellayani as a preliminary evaluation trial by raising each variety in a single line. The varieties which included the recommended varieties, like TMV 2,7,9 and Pollachi-1 showed general adaptability. But the varieties showed great variability with respect to yield of pod/plant, haulm weight/plant, branching, canopy, compactness, seed dormancy, duration, etc. Some of the varieties like M-13, ICG 3059, S-7-2-13, EC-112027, AH-6915, Spanish Improved, AK-811, J-11, KG-61-240, TG-14, TG-17, Gangapuri, Big Japan etc. yielded, on an average, 100 per cent more than the standard varieties.

Sixty five varieties were put under a preliminary evaluation trial in summer rice fallows on 31-1-1981 at the Instructional Farm, Mannuthy. The varieties performed well in rice fallows and showed wide variation in growth habit and other morphological and agronomic traits.

### *Yield components and selection index in groundnut (Vellayani)*

The experiment was designed to identify the factors contributing towards higher yield of pods and to formulate a selection index. Twenty six bunch type varieties of groundnut obtained from the Oil Seed Experiment Station, Tindivanom were put in the initial evaluation trial for assessing their performance under Vellayani conditions.

### **Crop management**

#### *Manurial trial on groundnut (Kayamkulam)*

To find out the optimum level of N, P and K for groundnut in sandy tracts, a manurial trial was conducted from 1977. During 1980-81, pod yield and mean number of pods for 10 plants were recorded. Due to severe attack of rats in the plot, pod yield/plot was vitiated. During the previous year, there was no significant effects due to the treatments. Maximum yield was recorded by  $N_3P_3K_3$ .

#### *Studies on the cultural and management practices of groundnut in sandy loam soils of Onattukara paddy fields (Kayamkulam)*

To evolve an appropriate technology for the effective utilization of the time interval during the third crop season for a profitable cultivation of groundnut in rice fallows, a trial was conducted from 1979 onwards. During 1980-81, maximum yield : (1590 kg/ha) was recorded in V4 T3 (dibbling after land preparation + lime 1000 kg/ha + hoeing 45th day after dibbling) followed by V3 T4 (dibbling after regular land preparation and hoeing on the 15th and 30th day after dibbling) with 1348 kg/ha.

#### *Scheduling irrigation to groundnut (Chalakydy)*

Results showed that the differences in yield of pods either due to water management or due to the varieties were not significant. However the interaction between water management and varieties differed significantly during the year under report. It was concluded that among the different levels of water management, irrigation at IW/CPE=0.5 was the best.

#### *Effect of date of planting of groundnut as intercrop on the yield of groundnut and tapioca (Vellanikkara)*

The object of this experiment was to find out the best time of planting of groundnut as intercrop in tapioca. The yield of tapioca ranged between 10505 kg/ha and 20171 kg/ha. The yield of groundnut ranged between 243 kg pods/ha and 1395 kg/ha. The experiment will be repeated for drawing conclusive results.

#### *Studies on the optimum seed rate and spacing of groundnut as intercrop in tapioca (Vellanikkara)*

The object of this experiment was to find out the optimum seed rate and spacing of groundnut as an intercrop in tapioca. There were

altogether 10 treatments in this experiment. Intercropping topioca with single row of groundnut at a spacing of 30 cm or 20cm was found advantageous.

*Studies on host varietal specificity of Rhizobium for nodulation in groundnut (Vellayani)*

A pot culture trial was conducted with seven groundnut varieties and *Rhizobium* strains to study the host/varietal specificity of *Rhizobium* to groundnut varieties.

*Studies on the performance of bunch and semi-spreading varieties of groundnut under different levels of foliar and soil application of boron (Vellayani)*

The experiment was conducted to study the performance of two new varieties of groundnut TMV-11 (bunch) and TMV-10 (semi-spreading) under the agro-climatic conditions of Vellayani. The study also aimed to find out the effect of foliar and soil application of boron in increasing the yield and quality of groundnut. The results revealed that TMV-10 was superior to TMV-11 in yield of pods. TMV-10 recorded an yield of 2102 kg pods/ha as against 1971 kg/ha by TMV-11. Soil application of borax at 12.5 kg/ha recorded maximum pod yield (2214 kg/ha) which was significantly superior to control (1890 kg/ha). Foliar application of 2.5 kg borax/ha gave the highest yield of 2197 kg pods/ha as against 1843 kg pods/ha by control.

*Response of groundnut to phosphorus and potassium under different water management practices (Chalaky)*

The main objective of the experiment was to study the growth and yield response of groundnut to different irrigation schedules and to find out the optimum levels of phosphorus and potassium required by the crop under irrigated conditions and to study the economics of irrigation and nutrient application to groundnut. The experiment has been completed. Data collected on yield characters and yield are being analysed.

*Effect of cultural practices and liming on groundnut in rice fallows of Onattukkara (Kayamkulam)*

The aim of the experiment was to find out the most suitable cultural and management practices for groundnut during the third crop season rice fallows. Data collected on germination, height of plants at different stages, branching, pod yield, haulm yield, shattering, 100 seed weight, seed protein content, oil content, and soil moisture studies are being analysed.

*Studies on the effect of lime and phosphorus on growth and yield of groundnut grown in summer rice fallows (Mannuthy)*

The experiment was conducted during the third crop season of 1979-80 to study the performance of three varieties of groundnut under graded levels of lime and phosphorus.

## SOYBEAN

### CONCLUDED PROJECTS

#### Crop improvement

##### *Genetic divergence, combining ability and heterosis in soybean Vellayani*

Sixty five varieties of soybean collected from different sources were evaluated for genetic divergence. The varieties were grouped into 13 genetic constallations by employing the D<sup>2</sup> technique. Selected varieties from the different clusters exhibiting genetic divergence were crossed. Heterosis was exhibited by several hybrids. The magnitude of the heterosis for the different characters in the hybrids was estimated.

##### *Screening of soybean varieties (Vellanikkara)*

The varieties showed wide differences in performance in the different season. Based on the performance of the varieties in the South-West monsoon seasons, the varieties EC-92814, Arkur, PL 5018, Monetta, Davis and JN 2750 were selected as superior ones. Based on the performance in the North-East monsoon season, varieties EC 14437, EC 2669, Improved Pelican, EC 92814, EC 39824, and EC 63290 were selected as superior ones.

### ONGOING PROJECTS

#### Crop improvement

##### *Comparative performance of soybean varieties (Vellanikkara)*

Fourteen varieties selected based on the earlier screening work were advanced to field experiments. Data are being processed.

#### Crop management

##### *Effect of levels of potassium and Rhizobial culture inoculation on the growth and yield of soybean (Vellanikkara)*

The experiment aimed at comparing the performance of soybean to graded levels of potassium with and without culture inoculation. The objectives were to arrive at the extent of response of soybean to potassium and to confirm the earlier observations of a lack of response or decrease in yield of soybean, consequent to *Rhizobial* culture application.

## CASTOR

### ONGOING PROJECTS

##### *Evaluating the prospects of popularising large scale cultivation of castor in Kerala (Vellayani)*

Twelve varieties were collected from Hyderabad and Salem. All the varieties were sown in winter. The varieties except one germinated. Salient morphological features were recorded. From the growth pattern it was suspected that the varieties were season bound.

## ESSENTIAL OILS & MEDICINAL PLANTS

### CONCLUDED PROJECTS

#### Crop improvement

##### *Varietal trial on palmarosa (Odakkali)*

The objective is to find the best variety with regard to oil yield and geraniol content. The result showed that the cultivar ODP 2 - a selection from the variety introduced from Haldwani was superior to the existing ODP-1. The physico-chemical properties of the oil of ODP-2 was within acceptable limits. The cultivar is to be put in a bulk yield trial before releasing it for large scale cultivation.

##### *Adaptability studies on North Indian vetiver hybrids (Odakkali)*

ODV-13, a hybrid variety from North India recorded maximum root, oil yield and oil recovery percentage. ODV-13 was found to be superior to all other varieties in oil yield. With regard to disease infection by *Helminthosporium*, T1, T2, T12 and T13 were least affected. The cultivar ODV-13 gave 68% increased yield over the improved local cultivar Nilambur.

The cultivars which yielded more than 40 kg/ha of oil (ODV-12, ODV-13, ODV-14, ODV-20 and ODV-3) will be put under bulk yield trial for selecting the best one.

### ONGOING PROJECTS

#### Crop improvement

##### *Germplasm collection in medicinal plants (Vellanikkara)*

Initial work to establish a Centre for Research on Medicinal plants under the Department of Plantation Crops & Spices has been started. Different medicinal plants from various parts of Kerala have been collected and maintained in the garden.

##### *Introduction and adoption studies of aromatic plants (Ambalavayal)*

The objective is to find out the possibility of successfully cultivating some of the essential oil yielding plants which are of high demand in the market.

##### *Introduction and adoption studies of medicinal plants (Ambalavayal)*

The objective is to find out the possibility of successfully cultivating some of the rare medicinal plants which are of high demand at present.

##### *Comparative yield trial of promising types of lemongrass collections with OD-19 (Odakkali)*

Among the seven varieties, OD-410 gave maximum oil yield; but its citral content was less. OD-19 recorded the maximum citral content. The promising types will be advanced to bulk yield trial.

*Evaluation of the production potential of induced lemongrass mutants (Vellayani)*

The intention is to start a replicated trial with selected mutant clones of lemongrass. Yield of grass, essential oil content and their morphological characters will be evaluated.

*Induction of flowering in American lemongrass (Vellayani)*

Three concentrations (50, 100 and 200 ppm) each of GA, IAA and 2,4-D were tried in American Lemongrass. It showed no sign of flowering and hence higher doses of growth regulators and cutting of the top were tried. The treated plants did not respond to the application of the chemicals.

*Induction of auto tetraploids in lemongrass (Vellayani)*

Seeds of the variety, OD-19 were treated with colchicine at different concentrations. Treated seeds were sown and observations made. Seeds treated with lower concentrations showed higher survival. The plants were studied for vegetative & flowering behaviour. Pollen sterility was also assessed. Based on the observations, plants which are likely to be polyploids were identified for detailed morphological studies.

*Induction of mutation and polyploidy in lemongrass (Vellayani)*

Seeds of the variety OD-19, were irradiated with gamma rays. Fortytwo mutant clones have been isolated after repeated screening. They were further examined for stability. The variation in respect of morphological characters was enormous. Fourteen mutant clones having high grain yield and oil yield are to be compared with the parent clone.

*District trial on palmarosa, Cymbopogon martini var: motia-Improved culture-ODP-2 (Haldwani) (Vellanikkara)*

The project was started to estimate the yield potential of OPD-2 and to compare it with the existing type ODP-1 under rainfed conditions and to study the adaptability of the variety under Vellanikkara conditions.

*Morphological and phytochemical investigations on the species of Solanum (Vellanikkara)*

Five species of Solanum (*Solanum incanum*, *S. indicum*, *S. khasianum*, *S. torvum* & *S. aculiatissimum*) were raised and their detailed morphology studied. The alkaloid content in the berries are being investigated. *S. torvum* showed maximum vegetative growth.

**Crop management**

*Effect of spacing, weight of planting material & time of harvest on the yield and quality constituents in Costus speciosus (Vellanikkara)*

The objective is to standardise the optimum population density, weight of planting material and the optimum stage of harvest, so as to increase the yield of rhizomes and thereby the recovery of active principle, diosgenin.



*Yield and quality constituents in Costus speciosus under varying levels of N, P & K (Vellanikkara)*

The objectives of the trial is to make a fertilizer recommendation for commercial cultivation of *Costus speciosus*, to improve its diosgenin yielding ability and to work out the economics of cultivation of this crop as a source of diosgenin. The experiment was laid out in May '80 and the crop was harvested in December 1980 after completing six months of growth observations.

*Studies on the uptake of nutrients by lemongrass (Odakkali)*

During the period, a total number of five harvests and distillation were done. Plant samples were also collected simultaneously for chemical analysis. Two harvests were completed. Analysis of plant samples have shown that uptake of potash was maximum by the plants.

*Effect of NPK on the grass, oil yield and quality of oil of lemongrass (Odakkali)*

Three harvests were obtained. Grass yield, oil yield, dry matter production and citral content were recorded. The treatment combination 150 kg N, 75kg P<sub>2</sub>O<sub>5</sub> and 50 kg K<sub>2</sub>O/ha recorded maximum grass yield, dry matter production and citral content. Oil yield was maximum for the treatment combination 100 kg N, 75 kg P<sub>2</sub>O<sub>5</sub>, 75 kg K<sub>2</sub>O/ha.

*Influence of applied nutrients and stage of harvest on the yield and physico-chemical properties of essential oil of palmarosa (Odakkali)*

Biometric data on grass and oil yield, and physico-chemical properties were recorded. Harvesting the grass at 45-50 days interval and application of fertilizers @ 75:75:75 kg NPK/ha gave the maximum quantity and quality of oil.

*Response of lemongrass varieties OD-19, SD-68 & RRL-16 to nitrogen (Odakkali)*

The objective of the experiment was to study the performance of three varieties of lemongrass under the agro-climatic conditions of Kerala and to study the effect of different levels of nitrogen on the growth, grass yield, oil yield and citral content. The field work has been completed. Data collected are being analysed.

*Manurial trial on Dioscorea floribunda (Odakkali)*

Analysis of the samples collected during the year showed that manuring with N at different levels had no effect on yield of tuber. The trial is to be repeated during 1981-82 for conclusive results.

**Plant protection**

*Studies on the fungal parasites of lemongrass (Vellayani)*

The project is aimed at detailed studies on symptomatology, pathogenicity, mode of spread, survival and control of the fungal parasites of lemongrass. Initial results revealed presence of *Helminthosporium*, *Alternaria*, *Curvularia*, *Colletotrichum* etc. on leaves, stems and flowers. A new disease of unknown etiology has been identified as malformation of the inflorescence.

## POST HARVEST TECHNOLOGY & NUTRITION

### CONCLUDED PROJECTS

#### *Dormancy behaviour of important high yielding paddy varieties cultivated in Kerala (Pattambi)*

Dormancy period ranged from 8 to 62 days during virippu and 2 to 40 days during mundakan season for the high yielding varieties. Longer duration varieties exhibited a longer period of dormancy with the exception of Mashoori where the dormancy was very short. Among the varieties tested, Triveni was having the lowest and Jagannath, the highest dormancy period during both the seasons.

### ONGOING PROJECTS

#### *Seed storage studies on rice—Evaluation of different containers for storing seeds under Kerala conditions (Pattambi)*

The object of the study is to find out the relative efficiency of different containers for storing paddy seeds without loss of viability. Seeds of Triveni and Jaya were utilised for the study and the data so far gathered showed that polythene lined gunny is a good container, having retained the viability for a longer period.

#### *Small scale processing of cocoa (Vellanikkara)*

Objective is to develop methods suitable for small scale extraction of cocoa butter, to study the manufacturing aspects of cocoa powder, to develop alternate uses for cocoa and to study the utilization of cocoa products. The fermented and dried beans were roasted at different temperature levels for varying periods. They were then utilized for the preparation of cocoa powder, cocoa beverage and chocolate. Beans roasted at 120° C for 20 mts were found to be better in quality than others.

#### *Maturity and post harvest studies in mango (Vellanikkara)*

Changes during maturity and post harvest stages in four varieties of mango were studied. Storage studies have also been taken up to find the effect of different methods on the shelf life and quality of mango.

#### *Dehydration, packing and storage studies of fruits (Vellanikkara)*

The objective of the programme is to find out the most effective packaging for the storage of dehydrated banana, jack & mango.

#### *Processing & acceptability of soybean (Vellanikkara)*

A procedure was standardised to remove the flavour from soybean. Different recipes with soybean were found acceptable.

#### *Loss of Vitamin C in green leaf vegetables under different methods of cooking (Vellanikkara)*

Drumstick, chekkurmanis & amaranthus leaves were analysed for estimating the loss of Vitamin C while cooking.

*Studies on the changes taking place in the physical and chemical properties of lemongrass oil during prolonged storage (Odakkali)*

Oil samples from different localities were drawn at monthly interval, and tested for the physicochemical properties such as specific gravity, refractive index, solubility and citral percentage. Data upto the second month of storing showed no reduction of citral. The trial will be continued for five years.

*Effect of antioxidants on the keeping quality of lemon grass oil kept in darkness (Odakkali)*

Control (antioxidants not applied) showed no reduction of citral upto the third month of storing while many of the antioxidants had a deteriorating effect. Some like pyrogallol (all concentrations), sodium chloride 1%, ascorbic acid 0.001%, ascorbic acid 0.1% and powdered chillies 1.0% maintained the initial citral level.

**SUGARCANE AND OTHER MISCELLANEOUS CROPS LIKE COTTON, JUTE AND MILLETS**

**SUGARCANE**

**ONGOING PROJECTS**

**Crop improvement**

*Screening of sugarcane varieties—Early and mid-late varieties (Chittur)*

The experiment aims at identifying early varieties which mature in 8 to 10 months, as well as mid late varieties which surpass Co.419 in yield and sugar recovery. The experiment was laid out in RBD in January 1981. The germination counts and tiller counts were recorded. The experiment is in progress.

*Zonal varietal trial—Series I (Thiruvalla)*

The experiment was started in the year 1979 with the objective of identifying suitable varieties for the region. Seven varieties were tried. Maximum yield was recorded by the variety Co. 740 which appeared to be a good ratooner when compared to the other varieties.

*Zonal varietal trial—Series II (Thiruvalla)*

The experiment with 14 varieties was laid out. The results indicated that the germination and millable canes were not significantly different between the varieties. However, shoot counts and yield were statistically significant. Co-62175 recorded maximum shoot count and yield. The variety F1-2 recorded the maximum brix and pol percentages (20.86 and 19.31, respectively).

*Germplasm evaluation (Thiruvalla)*

During the year under report, 73 varieties were collected from Coimbatore and Mandia and maintained. A total of 125 varieties have been collected so far.

### *Evaluation of flood resistant varieties (Thiruvalla)*

The experiment was laid out in March '81 with nine pre-release cultures and four popular checks to evaluate the flood resistance capacity of the pre-release cultures. The varieties differed significantly in the number of millable canes. The maximum was recorded by the variety CoC-771 and the minimum by Co. 6304 and CoA 7601. The varieties differed significantly in brix and Pol %. The highest brix and pol values were seen in the variety Co. 704 and CoC. 67-1. The lowest brix and pol values were recorded by Co. 995 and Co. 1340.

### *Evolution of new varieties suitable for the different tracts of Kerala (Thiruvalla)*

The object is to evolve varieties suitable for the different agro-climatic zones of Kerala with special reference to the requirements of each tract through hybridization and selection. From among the eight crosses effected during 1979-80, 248 selections were made from one thousand seven hundred and eighty seven progenies. During 1980-81, nine crosses were effected from which a total of 1714 seedlings were planted. The selections and the seedlings are being studied to be carried forward to isolate promising materials for large scale adaptive trials and release of varieties.

### *Screening of sugarcane varieties (Thiruvalla)*

Twenty two varieties under early duration and sixteen varieties under midlate group were subjected to the studies. Observations on germination, shoot count, number of millable canes, yield, sugar content, length, girth and number of internodes were recorded and analysed statistically. Observations were also recorded on the incidence of grassy shoot disease to assess the relative resistance of the varieties against the disease. The maximum germination was noticed in CoC-771 among the early duration varieties. Among the midlate varieties, Co. 658 ranked first.

### *Genetic variability, path analysis and stability parameters in sugarcane (Thiruvalla, Chittur, Ambalavayal)*

Forty eight varieties of sugarcane were grown in a comparative trial with three replications at Thiruvalla. Germination counts were taken at periodic intervals.

### *Variability and heterosis in intervarietal hybrids, of sugarcane (Thiruvalla)*

The correlation co-efficients between morphological characters and yield have been worked out. The extent of variability in the hybrid population is being estimated. Seventy eight selected seedlings were clonally propagated and planted in a replicated trial along with standard varieties.

## **Crop management**

### ***Fertilizer trial (Chittur)***

In order to find out the optimum nutrient requirement for sugarcane, a 3<sup>3</sup> confounded factorial experiment was laid out and planted in January 1980. The results of the study on plant crop revealed that highest number of millable cane was produced by the treatment receiving 225,100,0 kg/ha NPK.

### ***Effect of higher altitude on sugarcane seed material and on its yielding capacity in plains (Ambalavayal)***

The objective of the experiment is to study the seedling vigour of sugarcane produced at high altitudes and its performance when planted in plains. The data indicated that Co-997 produced the highest number of millable canes. In respect of weight of canes, juice and jaggery, Co-62175 was significantly superior.

### ***Introduction of sugarcane cultivation in Wynad on commercial basis (Ambalavayal)***

To find out the possibility of introducing sugarcane cultivation on commercial basis and its processing, an experiment was laid out. The results indicated that variety Co-62175 gave better yield over the other varieties.

### ***Effect of altitude on sugarcane seed material (Thiruvalla)***

To study the seedling vigour and performance of progenies of seed material from high ranges, seven varieties (four from Ambalavayal and three from Idukki) were tested along with the seed material from Thiruvalla. The seed materials of Co. 62175, Co-997 and Co-419 collected from Idukki were significantly superior to those from Thiruvalla in respect of germination. Co-997 and Co 419 of Thiruvalla recorded higher number of shoot. Co-62175 and Co-419 collected from Idukki gave a much higher number of canes. Co 62175 of Idukki recorded a mean yield of 140.59 tonnes as against 90.90 tonnes by Co-62175 of Thiruvalla. Co. 419 of Idukki yielded 87.81 tonnes/ha as against 57.57 tonnes/ha recorded by Co. 419 of Thiruvalla. From the experiment it can be concluded that the seed materials if raised in the high ranges and planted in the plains will yield a higher tonnage of canes.

### ***Ratoon management studies (Thiruvalla)***

The object of the experiment is to standardise ratoon management practices of sugarcane. The results showed no significant difference between the treatments. The maximum yield was obtained in plots receiving the treatment "removal of trash + no stubble shaving + manuring on the 25th and 75th day after harvest". It is however noticed that burning of trash in situ has no adverse effect and that stubble shaving is not an essential practice when the canes are cut close to the ground level.

### *Spacing cum manurial trial (Two series) (Thiruvalla)*

The object of the experiment is to determine the optimum spacing of sugarcane for maximum productivity and to find out the relationship between spacing and nutritional requirements of the crop. Two series of trials have been laid out (one with short duration variety Co.997 and another with medium duration variety Co.62175) with three levels of fertilizer and three levels of spacing. The results of the studies conducted in the first ratoon crop of the short duration variety showed that the different spacings have significant effect on the germination counts. 60 cm spacing is found to be superior to 75 and 90 cm spacings. Fertilizer levels had no effect on germination. With regard to yield, the spacing 60 cm between rows gave the maximum yield which was significantly superior to 75 and 90 cms. The different fertilizer levels had no effect in increasing the yield. The different spacings and fertilizer levels had no effect on the girth, height, internode, brix%, purity % and pol%. The experiment is being continued to study the effects of the treatments in the second ratoon also.

Studies conducted on the midlate variety Co.62175 showed that the different spacings and fertilizer levels had no effect on germination. In the case of millable canes, there was significant difference between the levels of spacing; but no effect was seen for the fertilizer levels. The interaction was significant. As regards yield, there was no significant difference between the different treatments. Observations on the girth, height, number of internodes, brix and purity percentages did not show significant difference for the different treatments. The experiment is being continued to study the effects of the treatments in the second ratoon.

### *Experiment to find out the best time of planting sugarcane (Thiruvalla)*

This experiment was started to find out the best time of planting sugarcane and to examine the feasibility of extending the crushing season by staggering the time of planting. The maximum number of millable canes and yield were recorded in Co.997 in the planting done on 1st December and the minimum in the last planting of 15th March. In the case of Co.72175, maximum yield of millable canes were recorded in the November 15th planting and minimum in the last planting in March. The yield and millable canes was satisfactory up to the 1st February planting. In the case of Co. 785 and Co. 449 also, this trend was noticed. Results obtained clearly indicated that maximum yield of cane in all the varieties can be expected by earlier planting and postponing the same beyond 1st February will adversely affect the yield.

### *Trials on the keeping quality and optimum seed rate of popular varieties of sugarcane (Thiruvalla)*

This experiment was done to find out the keeping quality and optimum seed rate of sugarcane sets. The four varieties studied were

Co.997, Co.62175, Co.449 and Co.785. There was significant reduction in weight according to the duration of storage in all the varieties. In the case of Co.62175, the weight loss was upto 10.75% for one month storage and for Co.997, upto 25%. In Co.449 and Co.785, the weight loss was 10% and 16.25%, respectively. The studies conducted on the percentage of viable buds in the seed setts revealed that there was drastic reduction in the number of viable buds when the seed setts were kept for long periods. It has been clearly indicated that the seed setts should not be stored for long periods. In order to get atleast 75% viable buds, the seed setts should be planted within a fortnight after harvest.

#### *Experiment to find out the effect of lodging of sugarcane (Thiruvalla)*

Three varieties of sugarcane (Co.997, Co.62175, and Co.785) were used for the purpose. Samples of erect, half lodged and fully lodged canes were put under study. Weight loss upto 31% in Co.997, 38% in Co.62175 and 38% in Co.785 was observed in the fully lodged canes. In the case of half lodged canes, the weight loss was upto 13% in Co.997, 19% for Co.785 and 10% for Co.62175. The loss in brix, pol and purity of the three varieties was significant for the half lodged and fully lodged canes. The loss in weight and the reduction in sucrose in the different varieties due to lodging indicated the necessity of propping canes to get maximum yield and sugar recovery.

#### *Studies on the companion crops in sugarcane fields (Thiruvalla)*

The objective of this experiment is to identify suitable companion crops for sugarcane and to work out the economics of the system. The companion crops like sunnhemp, cowpea, greengram, blackgram, bhindi, horsegram and jute were raised along with sugarcane. The companion crops except jute were raised one month earlier than the planting of sugarcane. The results of the experiment will be available only after the harvest of sugarcane during January 1982.

#### *Soil application of silicate slag on yield and juice quality of sugarcane (Thiruvalla)*

This experiment was planted in January 1979 and the results presented are from the 1st ratoon studies. Two varieties were studied under five levels of application of silicate slag. As regards germination, shoot counts and millable canes, the varieties and treatments did not differ significantly. In the case of yield of canes, there was no significant effect for the treatments. But the varieties were significantly different; Co. 62175 was found to be significantly superior to Co. 997. When the brix value was considered, the varieties and treatments did not differ significantly. There was no significant effect on the application of silicate slag for increasing the yield and juice quality in the plant crop also.

*Effect of soil amendment on yield of plant and ratoon sugarcane in acid soils (Thiruvalla)*

This experiment was laid out in the year 1979 with two varieties and four levels of lime. Lime did not show any effect on germination, shoot counts and number of millable canes in the varieties studied. But the yield increased by the application of lime and the maximum yield was obtained in Co. 785 at the lime level of 450 kg/ha and in Co. 997 at 300 kg/ha. The effect of lime on brix % was not significant.

**MISCELLANEOUS CROPS**

**ONGOING PROJECTS**

**Crop improvement**

*Maintenance and evaluation of germplasm of crops (Vellayani)*

Varietal collection was made of bhindi, brinjal, chillies, sesamum, groundnut, lemongrass, guineagrass and cowpea. Evaluation trials will be conducted during 1981-82.

Evaluation of brinjal types obtained from the cross between cultivated and wild types resulted in types resistant to bacterial wilt. Further screening trials are under progress.

*Study of reproductive mechanism in crops (Vellayani)*

The field experiment for estimating the extent of natural cross pollination in lemongrass was continued. The studies indicated the absence of natural cross pollination.

*Analysis of embryo structure in seeds (Vellayani)*

Mutational analysis of the rice embryo has been completed. The results indicated that in a mature rice seed embryo there are at least six mutually exclusive mutant sectors which do not share a mutation in common. Anatomical studies however have not been successful.

*Biometric analysis of yield attributes in para rubber, Hevea braziliensis, Muell. Arg. (Chethakal/Rannil/Vellayani)*

Based on preliminary studies, six trees were selected from each of the three replications from the 20 clones under study. Observations were recorded on girth of tree, bark thickness, tapping height, tapping panel length and wintering. Yield recordings are being done at fortnightly intervals. Number of tappings per month per season is also being recorded.

*Germplasm collection of rose, hibiscus, jasmine, ixora, bougainvillea and lotus (Observational trial) (Vellanikkara)*

A collection of 25 named cultivars, 25 other cultivars, and a few wild roses which could be used as root stocks was maintained. A new plot was planted with budded roses in March 1981. Fifty hibiscus



types were collected, of which 25 were collected from different parts of Kerala and others from Tamil Nadu Agrl. University, Coimbatore, and from U.A.S., Bangalore. Four species of jasmine, four of ixora and twenty types of crotons were also maintained.

*Testing the performance of bougainvillea cultivars evolved in India at different centres (Vellanikkara)*

Under this project, 20 varieties have been introduced and maintained.

*Testing the performance of Indian cultivars (including mutants) under different agro-climatic regions on different rootstocks Rosa indica, Rosa multiflora, Rosa bourboniana*

The experiment was laid out in RBD with 21 treatments. The budding of the rootstocks with seven improved varieties will be undertaken.

**Crop management**

*Scheme for the production of flower seeds and ornamental plants (Vellanikkara)*

Ornamental plants and tree saplings were produced, the majority of which were used for planting in the Main Campus.

*Morphological studies of different types of Hibiscus rosasinensis and standardisation of propagation technique (Vellanikkara)*

Morphological characters of 50 hibiscus types which were collected locally and from Coimbatore and Bangalore were studied. The number, weight, average length and maximum length of roots were studied at 20 days interval after treating the cuttings with IBA, IAA and NAA at 25, 50, 75, 100, 1000, 3000, 5000, 7000 and 10,000 ppm. The differences in rooting response of cuttings with and without leaves were studied. Pollen viability on seven types were studied. Air layering was tried on five types.

*Effect of time of planting and spacing on growth and flower production in marigold (Vellanikkara)*

The experiment was laid out in RBD with six treatments and four replications during 1979. Out of six plantings, four have been completed upto 1980-80. The observations on plant height, spread, days for first flowering, number of flowers/plant, weight of flowers/plant, size of flowers, duration of flowering and seed yield were recorded.

*Nutritional studies in tube rose (Vellanikkara)*

This experiment was laid out during 1979 with three replications and 15 treatments. Month-wise observations such as plant height, time and duration of flowering, length and number of spikes, size and number of flowers and weight of flowers/plant were recorded.

*Effect of bulb size and spacing on flower production in tuberose (Vellanikkara)*

This experiment was laid out during 1979, replicated four times with six treatments (spacing). Month-wise observations were recorded on plant height, time and duration of flowering, length and number of spikes, size of flowers, number of flowers and weight of flowers/plant.

*Experiment to find out the best time of sowing jute (Thiruvalla)*

The objective of this experiment is to find out the best time of sowing jute under Kerala conditions. Two varieties (JRC-212 and JRC-7447) were used in the study and the sowing was started at fortnightly intervals from 15.9.1980 and continued upto 1.12.1980. The crop in all the sowings, though germinated uniformly, failed to establish due to severe neckrot and drought. Further sowings could not be done as viable seeds were not available. It is proposed to start the experiment afresh from September 1981 onwards.

*Response of ragi to different levels of nitrogen, phosphorus and potassium under rainfed conditions (Vellayani, Pattambi)*

A field experiment was conducted to study the effect of nitrogen, phosphorus and potash on ragi variety P. R. 202. Nitrogen at three levels (30,60 and 90 kg/ha), phosphorus at three levels (20,40 and 60 kg/ha) and potash at three levels (20,40 and 60 kg/ha) constituted the treatments. The study revealed that grain yield was favourably influenced by the added nutrients. In the case of nitrogen, the response was linear. With regard to phosphorus and potash, the responses were quadratic. The optimum dose of phosphorus was found to be 51.7 kg  $P_2O_5$ /ha and that of potash 54.13 kg  $K_2O$ /ha.

## FODDER CROPS

### CONCLUDED PROJECTS

#### Crop management

*Development of an economic forage cropping pattern for the middle laterite belt of Kerala (Vellanikkara)*

Mixing cowpea with perennial grasses led to a drastic decline in grass yield and also the total forage yield. The yield decline in perennial grasses ranged from 36.50 percent in hybrid napier to 50.30 percent in guinea grass. The total forage yield was higher when annual grasses were mixed with cowpea. The combination of annual grasses with legume appeared to be compatible.

*Fodder production potential of grass-legume mixtures (Vellayani)*

The experiment was conducted to find out grass-legume mixtures suitable for Kerala conditions and to determine the effect of graded

doses of phosphorus on grass-legume mixtures. Inter-cropping increased the green fodder yield significantly. Maximum yield was obtained when the grasses were intercropped with *Stylosanthes*. The effect of phosphorus on green matter yield was significant upto 120 kg P<sub>2</sub>O<sub>5</sub>.

*Effect of nitrogen levels and row spacing on the yield and quality of hybrid napier grown with and without legume (Vellayani)*

The results showed that 100 and 150 cm row spacings of grass recorded significantly higher green matter yield than 200 cm, eventhough the former two were on par. Green matter yield increased significantly in the presence of rice bean. Intercropping along with nitrogen application at 60 kg N/ha gave optimum production of green and dry fodder yield.

## ONGOING PROJECTS

### Crop improvement

*Breeding of improved varieties of forage crops (Vellayani)*

Selected mutant clones and control revealed significant difference in green fodder yield. Based on the mean yield, three clones namely 2,6 and 12 were selected for further trials. Along with the parental clone (F. R. 600) and another improved variety, these clones were put under C. Y. T. under coconut gardens.

*Induction of mutation in guinea grass (Vellayani)*

Pure seeds of the guinea grass variety FR 600 were collected and subjected to gamma irradiation and treated with Ethyl Methane Sulphonate. A replicated field trial was conducted for both gamma irradiated and chemical mutagen treated seeds and the M1 progenies raised. Observations on growth and pollen sterility were noted. Off-types were isolated and are being advanced to M1 V1 generation.

*Correlation and path coefficient analysis in guinea grass (*Panicum maximum* Jacq) (Vellayani)*

Twenty four diverse clones of guinea grass have been put under an R. B. D. with three replications

*Advance varietal trial on multicol sorghum (Vellayani)*

The objective was to find out the fodder production potential of 12 multicol sorghum varieties. The varieties did not differ significantly in green fodder yield. However, maximum green fodder yield of 26.8 t/ha and dry fodder yield of 5.7 t/ha were recorded by the variety X-988.

*Initial evaluation trial of cowpea (Vellayani)*

The objective was to evaluate the performance and fodder yield of 10 cowpea varieties. Observations like green fodder yield, dry fodder yield, and leaf stem ratio were recorded. Results showed significant difference between varieties. The variety Russian Giant recorded the maximum yield (21.6 t/ha).

#### *Final evaluation trial of cowpea (Vellayani)*

The experiment was conducted with 16 varieties of cowpea to evaluate the performance and fodder yield. Significant difference between varieties was not observed. However, the variety UPC 2201 produced the maximum fodder yield (24.69t/ha).

#### *Final evaluation trial on dinanath grass (Vellayani)*

The experiment was done with the objective to evaluate the performance of 16 varieties of dinanath grass. Among the varieties, IGFR 852 recorded the maximum yield of 34 t/ha.

#### *Final evaluation trial of maize (Vellayani)*

The objective of the experiment was to evaluate the performance of 10 varieties of maize. The varieties did not differ significantly. However, maximum green fodder yield (15 t/ha) was recorded by the variety NLD and Ganga-2

#### *Initial evaluation trial on guinea grass (Vellayani)*

Eight guinea grass varieties were evaluated for fodder production potential. The variety PGG-3 recorded the maximum yield.

#### *Final evaluation trial on bajra (Vellayani)*

The objective of the experiment was to evaluate the performance of 25 varieties of bajra. The variety LC-6 recorded maximum fodder yield (19.3 t/ha).

#### **Crop management**

#### *Fodder production potential of sweet potato under varying levels of nitrogen (Vellayani)*

The results showed that the local variety 'Kottaram chola' produced green fodder yield upto 8 t/ha, at the level of 60 kg N/ha.

#### *Effect of growth regulators (Planofix) on seed production of forage crops (Vellayani)*

Cowpea variety C-152 was tried. Maximum seed yield of 1083 kg/ha was obtained by the application of 20 ppm planofix.

#### *Seed production potential of cowpea under different phosphate levels (Vellayani)*

Five cowpea varieties were tried under different phosphate levels. Maximum seed yield 358 kg/ha was recorded by the variety PC 5286 under 25 kg P<sub>2</sub>O<sub>5</sub>/ha.

#### *Effect of Cycocel on seed production potential of sorghum (Vellayani)*

Sorghum variety M. P. Chari was tried and CCC was applied in two stages of crop growth. Maximum seed yield of 4.08 t/ha was obtained by spraying CCC on the 45th day @ 0.50 kg/ha.

#### *Comparative performance of cowpea varieties under different spacing and seed rates (Vellayani)*

Results showed that the variety C. 152 was superior in green fodder yield.

*Effect of plant population on the yield and quality of Koobabool (Vellayani)*

The experiment was started during 1978 to study the performance of Koobabool under varying levels of plant densities. Data on green fodder yield recorded during the year showed that maximum green fodder yield of 3.11 t/ha was recorded by the treatment 2.0 m x 20 cm spacing.

*Evaluation of production potential of grasses and legumes under varying combinations with forage trees (Vellayani)*

The objective of the experiment was to evaluate the fodder production potential of varying combinations of fodder grass legumes and trees and to select the best silvipastoral combination suited for coconut gardens. The results revealed that maximum green fodder yield of 14.5 t/ha was recorded by the treatment combination koobabool + guinea grass + velvet bean.

*Seed production potential of Stylosanthes gracilis (Vellayani)*

The experiment was laid out to find out the effect of number of cuts and phosphorus nutrition on the seed production potential of *Stylosanthes gracilis*. The work has been completed and analysis is in progress.

*Production potential of different silvipastoral combinations (Vellayani)*

The experiment was conducted to explore the possibility of increasing fodder production of grasses/legumes under varying combinations with forage trees and to find out a suitable silvipastoral combination that can be adopted under Kerala conditions.

*Fodder production potential of sorghum/legume mixtures in coconut garden (Vellayani)*

The experiment was conducted to select the most suitable leguminous component crop to be grown mixed with fodder sorghum and to assess the yield and quality of fodder sorghum under mixed cropping pattern, compared to pure cropping.

*Production potentiality of fodder cowpea varieties with nitrogen and lime levels in coconut gardens (Vellayani)*

The experiment was laid out to identify the suitable fodder cowpea variety for coconut garden and to fix up the optimum level of nitrogen and also to assess the total green fodder yielding ability of different cowpea varieties under different lime levels. The field work and laboratory work have been completed.

*Fodder production potential of maize legume mixtures in coconut gardens (Vellayani)*

The experiment was laid out to select the most suitable leguminous component crop to be grown with fodder maize, to assess the yield and quality of fodder maize in an intercropping system compared to pure

cropping, to assess the fertilizer economy in the intercropping system of maize and to evaluate the economics of fodder production in the intercropping system. The field work has been completed and the data collected on growth and yield characters analysed.

*Seed production in Stylosanthes gracilis under varying levels of population density, nutrition, moisture regimes and cuttings (Vellayni)*

The experiment was conducted to find out the best cultivar of *Stylosanthes gracilis* for seed production (along with seed rate) and to assess the nutritional requirements of the crop for seed production. The crop was sown during August 1980. Periodical observations were taken along with collection of soil and plant samples.

## PLANT PROTECTION

### CONCLUDED PROJECTS

*Management of Bandicota bengalensis (Vellanikkara)*

Among the traps (Bamboo noose trap, Adivil trap, and scissor type trap) none was found effective. The study further revealed that the live burrows can be easily bait poisoned as the rats seldom come out of the burrow. The best bait poison found was prawn powder+half milled rice+zinc phosphide mixture.

*Survey of the microbial diseases of important vegetable pests of Kerala and detailed study of the snake gourd semilooper Phytometra spp. (Vellayni)*

The objective is to survey the microbial diseases of important vegetable pests of Kerala and to study in detailed the disease of *Phytometra* spp. Four viroses, three mycoses and four bacterioses infecting some of the vegetable pests were detected. Detailed studies were taken up on *Bacillus pumilus* infecting *Phytometra* sp. which caused cent per cent mortality of 3rd and 4th instar larvae.

*Studies on movement and placement of systemic granular insecticides in soil in relation to control of pests of pulses (Vellayni)*

This experiment was taken up to study the movement of granular insecticides in different soil types of Kerala and the control of pests of pulses in relation to the placement of the insecticides. Results showed that the movement was found to be more in sandy soil followed by laterite, red and alluvial soils. Phorate moved more compared to Carbofuran and Disulfotan. Application of granules along rows between plants as well as broadcasting gave effective control of all species of insect pests of cowpea, compared to alternate row application and point application. Analysis of residues of insecticides showed that Disulfotan left maximum residues (0.54-1.4 ppm) and carbofuran the least (.066-.127 ppm) with Phorate at intermediate levels (0.38 to .79 ppm).

## ON-GOING PROJECTS

### *Studies on the pests of chromolaena (Eupatorium odoratum) and Lantana camara (Vellanikkara)*

A preliminary survey conducted revealed three aphids namely *Aphis spiraccola*, *A. fabae* and *Brachycaudus helichryses* infested *Eupatorium*.

### *Taxonomical studies of crop pests and their parasites in Kerala (Vellanikkara)*

The technical programme has been revised recently and study of pests complex of paddy has been initiated.

### *Studies on the consumption, digestion and utilization of food plants by the caterpillar Pericallia recini (Vellanikkara)*

Response in the consumption of foliage of eight food plants namely, banana, brinjal, castor, colocassia, pumpkin, sweet potato and sesamum by the test insects were studied. The weight gained, amount of food ingested and faeces cast were recorded. Analysis of N utilization is being done. The experiment is in progress.

### *Studies on the sex ratio regulation in Bracon brevicornis (Vellanikkara)*

The objective of the study is to standardise laboratory rearing techniques of *B. brevicornis* to ensure optimum sex ratio in successive generations. The study revealed that a higher number of progenies were produced when heavier larvae (30-35 mg body weight) were exposed for parasitization at TH2 combination and with lighter larvae (8-10 mg. body weight) at TH3 level.

### *Studies on the sex ratio regulation in Bethyids (Perisierola nephantidis Vellanikkara)*

It was observed that 80% and 90% RH with three levels of temperature viz. 25, 27, and 28° C were unfavourable for production of more female progenies.

### *Studies on the control of stem borer Plocaederus ferruginea (Vellanikkara)*

The objective of this experiment is to find out suitable control measures against cashew stem borer. Cashew plots were selected for the layout of the experiment.

### *Studies on the temperature-humidity tolerance of Bethyid parasite P. nephantidis (Vellanikkara)*

Five levels of RH viz. 50, 60, 70, 80 & 90% and three levels of temperature viz. 25, 27 and 29°C tested revealed that 80% and 90% RH with all the three levels of temperature were unfavourable for fecundity and progeny production of the insect parasite.

*Seed biology and seedling characteristics of important weeds of Kerala (Vellankkara)*

Higher number of seeds per fruit, lower seed weight and smaller size of seeds have contributed significantly to wider distribution of weed seeds. Variation in germination percentage of weed seed were due to differences in environmental factors. Seedlings with lower shoot/root rating had well developed root system.

*Investigations on the weed flora of Kerala (Vellayani/Vellankkara)*

Specimens of 350 available weeds have been collected. The process of collection and preparation of a herbarium is in progress.

*Fungal diseases of plant and leaf hoppers of rice (Vellayani)*

Object of this experiment is to detect various naturally occurring fungal pathogens affecting BPH, white Jassid, green spotted Jassid and zig-zag hopper of rice and to assess their relative efficacy and utility in pest management. A new fungal pathogen infecting *Cicadella spectra* has been isolated and is yet to be identified. Infectivity of the fungi *Syncephalastrum racemosum* and *Penicillium exalicum* were tried on B P H and both were found to cause 70 & 75% mortality. Safety tests to six crop plants were carried out and these fungi were found to be safe to the crop plants.

*Use of Paecilomyces farinosus in the control of brown plant hopper, coconut leaf caterpillar and leaf folding caterpillars of Amaranthus (Vellayani)*

The project aims at testing the efficacy of *Paecilomyces farinosus* in controlling the above mentioned pests under field conditions. Results obtained show that the fungus is a virulent pathogen causing heavy mortality to B P H and coconut leaf caterpillars.

*Investigations on disease incidence in Oryctes rhinoceros (Vellayani)*

The objective of the project is to study the potent causes of bacterial pathogen of rhinoceros beetle of coconut in Kerala. Survey of the field collected grubs of rhinoceros for disease incidence revealed an entomogenic spore forming bacterium identified as *Bacillus cereus* Fr & Fr.

*Studies on the use of Bacillus cereus Fr & Fr. for the management of Lepidopterous crop pests (Vellayani)*

The project is intended to study the use of *Bacillus cereus* for the control of important caterpillar pests of Kerala. The host susceptibility of *Bacillus cereus* against different larval stages of laboratory bred *Anadentia peponis*, *Pericallia ricini*, *Diacrisia obliqua* and *Spodoptera mauritia* was tested. Only second and third instar larvae of *S. mauritia* gave desired percentage mortality.



*Microbial diseases of store pests of Kerala and their utilization in pest control (Vellayani)*

The object is to investigate the microbial diseases of important store pests of tapioca, rice, cashew and copra. Samples of store pests, *Corcyra cephalonica*, *Tribolium castaneum* and *Necrobia rufipes* were collected and reared in the laboratory. Heavy mortality of the larvae of *Corcyra* were recorded and the causal organism was found to be a rod shaped bacterium.

*Survey of microbial pathogen associated with major insect pests of Bhindi (Vellayani)*

Object is to study the natural incidence of pathogenic agents infecting major insect pests of bhindi and to evaluate the relative importance. Three endopathogenic bacteria viz. *Pseudomonas aeruginosa*, *Bacillus cereus* and *Bacillus thuringiensis* were isolated, established Koch's postulates and identified from the field collected diseased larvae of *Earias vitella*, *Heliethis armigera* and *Eublemma olivaceae*.

*Insect growth regulators for the control of pests infesting bhindi, brinjal and cowpea (Vellayani)*

The project aims at evaluating the use of insect growth regulators in controlling pests of some vegetable crops. In this experiment it was found that Exirane (R-20458) sprayed brinjal leaves when fed to different instars of epilachna beetle caused various types of abnormalities and mortality. Dimilin at 0.1% and 0.01% concentrations used against last instar larvae caused complete mortality of bhindi leaf roller *Sylopta deregata*.

*Use of NPV of snakegourd semilooper *Anadevidia peponis* Fab. (Noctuidae: Lepidoptera) in pest management (Vellayani)*

Objective is to assess the suitability of NPV isolated from *Anadevidia peponis* in pest management. All the larval instars except last instar were found highly susceptible to NPV. The virus could infect adults also. Cross transmission studies showed that this virus is highly host specific. This was found quite safe to silk worm.

*Studies on virus diseases (polyhedrosis and granulosis) of lepidopterous crop pests of Kerala (Vellayani)*

Objective is to make a survey on the virus diseases of important lepidopterous crop pests of Kerala and to determine the suitability for utilization in microbial control programme. During the year under report the virus diseases detected were NPV of *Nephantis serinopa*, NPV of *Anadevidia peponis* & NPV of *Margarenia indica*.

The NPV of *A. peponia* & *N. serinopa* were found to infect adults also. It was also found to be highly host specific.

*Studies on the adaptability of sericulture in Kerala (Vellayani)*

Object of this project is to assess the feasibility of adopting sericulture under different ecological conditions of Kerala as a village industry. During the year, three rearings were conducted.

Cocoon production was found to be above average @ 44.9 kg/100 layings and an average of 90% spinning was obtained. Leaf production under irrigated condition and a varietal trial were carried out, for maximisation of leaf production in mulberry.

*Joint action of insect pathogens-Insecticide mixtures in the control of crop pests (Vellayani)*

This project is aimed at undertaking studies on the utility of combinations of the pathogens with insecticides in the control of crop pests. NPK of *Spodoptera mauritia* and different insecticide combinations on *S. mauritia* were studied. Fenthion and Quinalphos combined with the NPK showed very good synergistic effect when tried on *S. mauritia* caterpillars.

*Insecticide deposits and residues on paddy with respect to the volume of spray fluid applied at different growth stages of the crop (Vellayani)*

Objective is to find out the minimum volume of spray fluid required for covering one hectare of paddy at different stages of the crop and to evolve a statistical model for the deposits and residues in terms of total leaf area and volume of spray fluid. A field experiment was conducted and deposit and residues at different intervals after spraying were measured by colorimetry. The second field experiment is in progress.

*Studies on the use of aluminium phosphide for the control of storage pests (Vellayani)*

This project aims to study the bio-efficacy of Phosphene for the control of storage pests and to determine the residues in the fumigated material. Fumigation trials were conducted in the fumigatorium with 45g of aluminium phosphide/1000 ft<sup>3</sup> for 3 days for various insects. The mortality ranged between 80-100% for larvae, pupae and adults. The results were confirmed by conducting trials in F. C. I. godowns at Trivandrum

*Role of metal chelate complexes in inducing resistance to tissue borers of rice (vellayani)*

A preliminary pot culture experiment was conducted to assess the capability of chelated metal complexes in inducing resistance to tissue borers of rice. EDTA caused slight phytotoxicity and retarded growth of plants. The pest population during the experimental period was periodically observed.

*Control of pests of stored paddy with antifeedant and newer insecticides (Vellayani)*

The project aims at studying the effect of six insecticides and eleven antifeedants on two major pests of stored paddy-lesser grain borer, *Rhizopertha dominica* and Angoumois grain moth, *Sitotroga cerealella*. From the work done it was observed that spraying of Phoxim on gunny bag surface at 600 mg/aim<sup>2</sup> was the most effective and economic treatment.

*Biological activity of different plant extracts with particular reference to their insecticidal, hormonal and antifeedant actions (Vellayani)*

Leaf extracts of *Ageratum conyzoides* and *Mentha arvensis* were found to have significant biological activity on red cotton bug and epilachna beetles.

*Insect mycosis caused by *Pacilomyces farinosus* (Dickson ex Fries) and the scope for utilizing the pathogen in pest control (Vellayani)*

The study aims at assessing the suitability of the pathogen *P. farinosus* in practical pest management programme. The pathogen was found to be cross infective to *N. serinopa* and *Nilaparvata lugens* (Stal) causing heavy mortality.

*Effect of levels of pesticides on control of paddy pests and water pollution in Kuttarad (Vellayani/Moncompu)*

Objective of the experiment is to ascertain the lowest dose of insecticides effective against different pests of paddy and which cause the least disturbance of the eco system. Field experiments have been completed and the data are to be analysed.

*Studies on the adaptability of sericulture in Kerala (Ambalavayal)*

Under this scheme, arrangements for making rearing rooms, and equipment as per the specification given have been made. The trial rearing will be started soon.

*Biological control of *Salvinia molesta mitchell* utilizing *Paulinia acuminata de geer* (Vellanikkara)*

Laboratory cultures of *Paulinia acuminata* were maintained and periodic releases were made in different parts of the State. During the period under report, 785 adults and fourth instar nymphs and 230 oothecae were released. The establishment was not recorded in any of the colonization sites due to the incidence of a bacterial disease. However, recoveries were continuously obtained from Ambalathara (Trivandrum district).

Surveys to monitor the natural enemies associated with the grass hopper in aquatic habitats were continued and during the period a few species of salticid spiders were found to be predatory on the nymphs.

*Studies on the control of bacterial disease infesting the nymphs (Vallanikkara)*

Trials were conducted on the feasibility of rearing the grass hoppers on *S. molesta* grown in water mixed with Streptopencillin, Pencillin, Streptomycin and Agrimycin, to ensure a terminal concentration of 500 ppm. There was no significant reduction in the mortality of adults due to the treatment. In another experiment, the salvinia mat was sprayed with these antibiotics and the adults maintained in the treated plants. In this experiment also there was no appreciable reduction in mortality due to the disease.

*Integrated control of S. molesta (Vellanikkara)*

Integrated control programme incorporating bio-suppressive measures are considered essential against *Salvinia molesta* which multiplies at a very rapid rate. Attempts to identify promising growth arrestants against the weed and to test their contact residual toxicity to *P. acuminata* was continued.

*Biological control of the terrestrial weed Chromolaena (Eupatorium odoratum Vellanikkara)*

A survey of the indigenous insects associated with *Chromolaena odoratum* was carried out and the following insects were recorded.

*Leptocentrus* sp (Membracidae)

*Cocostrephus* sp (Membracidae)

*Aphis spiraeicola* patch (Alphididae)

*Brachycandus helichrysi* (Klta) (Aphididae)

*Aphis fabae* (Scap) A. (Aphididae)

*Broceidochares utilis* insects released earlier in the high ranges of Kerala for the control of *Chromolaena adenophorum* could not be recovered, though these insects were found to cause gall formation on *Eupatorium glandulosum* in Idukki and Wynad areas of Kerala State. A survey on the relative incidence of the various insect enemies of *Chromolaena* has been initiated in Trichur district for collecting basic data on the incidence of native pests of the weed.

*Biological control Nilaparvata lugens stal (Vellanikkara)*

Survey on the natural enemies was continued and *Solenopsis geminata* (Formicidae) and *Microvelia* sp (Microvelidae: Hemiptera) was recorded as predator of the BPH nymphs. The soil water level was found to influence the predatory population, particularly of *Cyrtorhis lividipennis*. The parasites reared out from *N. lugens* included *Anagyrus* sp. from eggs and a drynid from nymphs and adults.

*Residual toxicity of fungicides in relation to the control of important plant pathogenic fungi (Vellayani)*

The main objective of the project was to determine the effective persistence of different fungicides on plant parts involving pathogens causing important diseases, of fruits and vegetables. The fungus *Colletotrichum gloeosporioides* was isolated from the leaves of bread-fruit plants for further study. Eight fungicides were tested. Bavistin and Blitox showed high percentage of inhibition on spore germination of the fungus. Other studies are underway.

*Synergistic effects fungicides and insecticides singly and in combination on plant pathogens and insect pests (Vellayani)*

Preliminary studies showed that the mixtures of Ekalux and Fytolan, Dithane M. 45 and Thriam gave better results than the use of Ekalux alone.

***Studies on Rhizobia isolation and mass production of efficient cultures of Rhizobia (Vellayani)***

Twenty four native and 5 isolates of *Rhizobia* suitable for cowpea were screened under pot culture conditions and found that a native isolate (C 14F) and one among the exotic isolate (6050) were promising ones in terms of number of nodules formed and dry matter content. Studies on the *in vitro* sensitivity of selected native and exotic isolates on various pH levels showed that native isolates are more tolerant ones. The comparative nodulation efficiency of these isolates are being studied under field conditions.

***Survey of edible species of Pleurotus and standardisation of techniques for large scale cultivation (Vellayani)***

Artificial cultivation of *Pleurotus sajor-caju* and *P. flabellatus* were tried using various substrates. A suitable method for large scale cultivation is to be standardised.

***Monographic studies on the genus Pleurotus and standardisation of techniques for its large scale cultivation (Vellayani)***

Morphological characters of few species of *Pleurotus* were studied. *In vitro* studies on suitability of few of them were taken up and the promising ones were selected for further detailed study.

***Studies on the cultivation of mushroom (Vellayani)***

In a survey of the mushroom flora of the state a new *Termitomyces* sp. was collected from many laterite zones of Kerala and identified as *T. robustus* and this is the first record of the same for India. A few other edible species of *Volvariella*, *Coprinus* etc., were collected and identified. *Rhizactonia solani* is found to be the most destructive disease in the mushroom beds. Among the different substrates tested or spawn production salvinia was also found to be suitable.

***Mass culture techniques for the production of Blue green algal cultures (Vellayani)***

The main objectives of the project was the mass production of blue green algae for distribution among the local farmers and standardisation of optimum conditions for fixation of N in soils. During the year isolation of native species of blue green algae was carried out. As a result two species were isolated and further studies are in progress.

***Utilisation of lemongrass waste for mushroom cultivation (Odakkali)***

The aim of the project was to prove the possibilities of utilization of the spent lemongrass after extraction of oil for the cultivation of paddy straw mushroom *Volvariella* and popularising the method among the farmers. The preliminary studies carried out show that the spent lemongrass is a good strata for the cultivation of the mushrooms. Further studies to standardise the methods are in progress.

*Survey on the occurrence of vesicular arbuscular micorrhizae in crop plants (Vellayani)*

The objective of the project was to study the occurrence of mycorrhizal association in crop plants of Kerala. The presence of vesicular arbuscular micorrhizae was observed in a large number of ornamental and also on plantation crops like rubber.

**SOILS AND AGRONOMY**

**CONCLUDED PROJECTS**

*Sown wind break studies (Vellanikkara)*

The experiment was concluded to study the effect of sown wind breaks on the growth and yield of paddy. The results showed significant effects due to spacing (of daincha) on the yield of grain and straw of paddy. Plots with 225 cm spacing recorded maximum yield of grain and straw. The yield gradually decreased as spacing between daincha rows became closer. The lowest yield was in the plots where windbreaks were not sown.

*Studies on the effect of lime and phosphorus on the growth and yield of groundnut grown in summer rice fallows (Vellanikkara)*

The study indicated that the effect of lime and phosphorus on the number of nodules per plant was not significant. Application of lime and phosphorus at higher rates could not significantly increase the pod yield, over the lower levels. But a positive trend was observed with increasing doses of applied lime and phosphorus.

*Effect of agro-engineering measures on surface run off and sub soil moisture storage in hill slopes (Vellanikkara)*

The study involved estimation of soil and nutrient losses from slopes planted with tapioca in two systems (mound and ridge) with and without groundnut. The results indicated that there was substantial decrease in soil and nutrient losses when the ridge system was followed. Groundnut inter cropping reduced these losses.

*Studies on the utilization of eupatorium for compost making (Mannuthy)*

Compost made out of eupatorium and glyricidia using different starters were assessed for their quality. The chemical analysis showed that there was no significant differences among the various treatments for NPK content.

*Studies on the physical properties of Kuttanad soils (Moncompu)*

The physical properties of Kuttanad soils were estimated. The bulk density of the soil was 1.17, particle density 1.60, porosity 41.5%, maximum waterholding capacity 41.4% and volume expansion 8.98 cc. per 100g dry soil. The other physical properties as well as the micrology of Kuttanad soils are to be studied.

*Effect of lime, phosphorus and rhizobium inoculation on the growth yield and chemical composition of cowpea. (Vellayani)*

Application of superphosphate at the recommended levels for cowpea increased the status of available nitrogen in the soil. Lime x rhizobium and lime x phosphorus x rhizobium interactions were significant in increasing the N status of the soil as well as the yield of the pulse crop.

*Zinc and manganese status of paddy soils of Kerala (Vellayani)*

Analysis of 150 samples of surface soils from the different soil type of Kerala showed the following ranges of total and available zinc and manganese.

Soil types	Zinc		Manganese	
	Total (ppm)	Available (ppm)	Total (ppm)	Available (ppm)
Poonthalpadam	36-660	0.4-7.8	92-830	6.50
Kole	20-400	0.4-3.1	130-375	6.46
Pokkali	79-270	0.9-4.8	73-145	2.8-15.6
Kari	58-140	0.4-5.6	64-189	2.0-9.2
Karappadam	30-700	0.4-7.8	88-330	8.45
Kayal	60-440	0.8-10.1	140-230	10.50
Coastal sandy alluvium	49-160	0.4-3.0	76-199	0.6-7.2
Lateritic alluvium	50-540	0.2-5.0	40-165	4-140

Incorporation of azolla and leafy organic materials increased the zinc status of the soil to a greater extent, beyond the direct contribution from treatment materials. Drying and draining the field on the 30th day of transplantation resulted in a doubling of the zinc status of the soils. This can be recommended as an agronomic practice in alleviating the zinc deficiency problem under wet land conditions. The 30th day of transplantation corresponds to maximum tillering of the rice crop when the zinc requirement is maximum.

*Potash nutrioperiodism in rice*

The effect of potassium at different stages of growth on medium and short duration varieties of rice was studied in pot culture using low land laterite soils from cultivator's fields in Pattambi and Trivandrum. The results indicated that half the recommended dose of potassium alone was sufficient for the expression of maximum yield in the short duration variety, Triveni. Application of urea along with potassium fertilizer as basal dose was found to reduce the availability and uptake of nitrogen at active tillering stage.

A detailed investigation on the important physico-chemical properties of 40 surface and (corresponding) sub-surface soil samples

of the pothalthadam area was carried out. The extent of nutrient fixation and the physico-chemical factors governing the fixation have been correlated.

Although the total amount of the important plant nutrients were high, their availability was only a small fraction, being 10% for N, 10% for P and 30% for K. The availability of N was significantly correlated with organic matter content. Lower rates of P & K availability is partly explained by chemical fixation of the nutrients.

The ammonium, phosphorous and potassium fixing capacity of these soils were 1.12-7.24 me/100 g soil, 2-60% and 1.04-7.93 me/100 g soils respectively. Ammonium fixation was correlated with organic matter, clay, free  $\text{CaCO}_3$  and silt content, Phosphorus fixation has been correlated with free  $\text{CaCO}_3$  and clay content. The slightly alkaline reaction of the soil as well as the presence of carbonates and bicarbonates of sodium may be considered responsible for the dispersion of the large amounts of clay which ultimately imparted undesirable physical properties to these soils.

#### *Soil testing methods for potassium in relation to cassava (Vellayani)*

The available potassium obtained by extraction of the soil with Neutral Normal ammonium acetate has been adjudged as having the maximum correlation with the total dry matter production and yield of cassava. Hence, Neutral Normal ammonium acetate is considered as the suitable reagent for determining available K status in these soils, based on which the potassium recommendations can be made.

#### *Utility of an indigenous source of magnesium silicate (Steatite) for rice in Kuttanad soils (Vellayani)*

A field experiment was conducted in the riverine alluvium (Karapadam soils) of Kuttanad to investigate the utility of magnesium silicate for rice. Application of powdered Steatite at 400 kg/ha in conjunction with NPK at the recommended levels resulted in significant increase in the yield of rice (Jyothi). The effect of this treatment was manifested through increased tillering and height of plants and increased straw yield. The study revealed the significance of magnesium and silicon in the nutrition of rice in the acid soils of Kerala.

#### *Effect of zinc on the growth and yield of rice (Vellayani)*

A field experiment was conducted in a cultivator's field in the Karapadam soils of Kuttanad (Edathua) to investigate upon the effect of soil and foliar application of zinc sulphate at varying levels. The application of zinc as foliar spray of 0.5% and soil application at the rate of 20 kg zinc sulphate per ha increased the yield of rice significantly. Application of Zn in conjunction with lime did not benefit, as straight application of this micro-nutrient.



*Studies on the genesis, morphology and physico-chemical properties of the laterite soils of Kerala (Vellayani)*

Pedological investigations of typical laterite soil profiles from 12 specific geoclimatic locations in Kerala have been conducted to study the extent of laterisation in different locations as well as to classify them according to the modern system of soil classification (soil taxonomy). The results indicated that Kerala provides an ideal pedogenic environment for the development of laterities. As against the popular belief, this process can be of contemporaneous origin when the forest areas of humid tropics with acidic moisture regime are denuded of its forest cover. The study revealed that organic matter content of the surface horizon at a level above 5% inhibits laterisation process. This underlines the significance of maintaining a high organic matter level in already laterised soils and preventing laterisation through the conservation of existing forest areas in the State.

**ONGOING PROJECTS**

**Soil fertility management**

*Influence of agro-techniques on surface run off and soil loss in hill slopes – Part II (Vellanikkara)*

The objectives of the study are to evaluate the extent of soil and nutrient losses in hill slopes planted to tapioca, with and without cowpea as the intercrop. Methods of planting include ridge and mound methods.

*Fertilizer retention in soils in relation to soil characteristics (Vellanikkara)*

The objective is to study the leaching loss of  $(\text{NH}_4)_2\text{SO}_4$  at different levels of organic matter. The experiment is in progress.

*Carbon-nitrogen relationship in Kerala soils (Vellanikkara)*

The objectives are to work out regression equation for calculating the total and available nitrogen in different types of Kerala soils using soil test values for organic carbon and to establish the minimum requirement of organic matter in the soil for economic yield. Soil samples were collected from different sites of the State during 1979–80.

*Increasing N use efficiency in upland soils (Vellayani)*

An incubation study was conducted using different ratios of oil cake to urea in lateritic upland soil and analysis of soil samples at 5 days intervals completed. Best ratios for mixing different oil cakes and urea as well as the pattern of mineralisation have been found out. The field experiment was laid out and samples analysed at periodic intervals.

## **Plant nutrition**

### *The relationship between soil nutrient status and foliar analysis of cocoa of different age groups in the various soil types of Kerala (Vellayani)*

Plant and soil samples have been collected from three locations in Trivandrum district and the analysis was carried out.

### *Studies on the shade response of common rainfed intercrops of coconut (Vellanikkara)*

This experiment aims at comparing the shade response of the common intercrops of coconut-ginger, turmeric, sweet potato and colocasia. The shade levels are 0,25,50 and 75 per cent.

### *Shade response of common rainfed intercrops of coconut-part II: legumes (Vellanikkara)*

This experiment aims at comparing the shade response of five legumes-red gram, cowpea, blackgram, ground nut and soybean.

### *Availability and requirement of phosphate to plants in the laterite soils of Kerala- Evaluation of available phosphate reserve of soil by chemical methods (Vellanikkara)*

Objectives of the project is to evolve a suitable chemical extractant for the estimation of available phosphate reserve (Ra-value) of soil.

Among the commonly used extractants for the estimation of available phosphorus (Bray No 1, Bray No. 2, Bray No. 4, Olser's and Truog's). Bray No. 2 and No. 4 extracted much higher quantities of phosphorus. Increasing the strength of HCl from 0.04 N to 1.0 N did not have any pronounced influence on the amount of phosphorus extracted. Among the various concentrations of HCl tried, 0.06 N acid extracted the maximum amount of phosphorus from the soil. Compared to Bray No.1, the performance of HCl was very poor. Sulphuric acid, when employed at concentrations analogous to that of HCl, extracted higher quantities of soil phosphorus. Phosphorus extracted at various concentrations correlated with the cumulative phosphorus uptake value at the end of the 6th crop. In the case of both  $H_2SO_4$  & HCl extractants, the major part of phosphorus was extracted within 30 minutes of equilibration and thereafter the release was very slow, at a constant rate. Combinations of  $H_2SO_4$  and HCl extracted higher quantities of P from soil than the individual acids and the influence was more profound at lower concentrations. The pattern of release of P by mineral acids during the varying periods of equilibration highly fluctuated especially when the acids were used individually. However, the degree of fluctuation was considerably less when the combinations of the acids were employed. Among the mineral acid extractants, phosphorus extracted by the combinations of 0.06 N  $H_2SO_4$  in 0.06 N HCl and 0.06 N  $H_2SO_4$  in 0.08 N HCl possessed the highest degree of correlation with the "Ra-value". Based on the

results of the preliminary screening trial of mineral acid extractants, 17 of them were carried forward for further studies. The main criteria in selecting these extractants was the consistency in the pattern of phosphorus released by these extractants at increasing periods of equilibration.

A pilot study for the selection of organic acids and their concentration for chelated system revealed that resorption of phosphorus extracted by the mineral acids can be increased by the presence of organic acids. Oxalic acid was more effective at the strength of 0.05 N, in extracting and chelating phosphorus from the soil. Therefore, oxalic acid at the strength of 0.05 N was employed along with the 17 mineral acid extractants selected.

For the mineral and organic acid combinations, a period of equilibration, not less than 30 minutes, was considered critical and optimum.

The co-efficients of correlation obtained between phosphorus extracted by the chelated extractants and cumulative phosphorus uptake were significant in soils in which the percentage of phosphorus is plants run below 0.025. Fixing the optimum period of equilibration as 30 minutes, extractant No. 10 (0.06  $\text{NH}_4\text{SO}_4$  & 0.06 N HCl in 0.05 N oxalic acid) was found to be superior to the remaining combinations.

Phosphorus extracted by Bray No. 1 failed to correlate significantly with phosphorus uptake by crops in soil groups in which the percentage phosphorus content of plants was below 0.025, 0.05 & 0.2, showing that Bray No. 1 is not an efficient extractant for the estimation of 'Ra-value' of the soil. Thus, the present study recommends the extractant 0.06 N  $\text{H}_2\text{SO}_4$  and 0.06 N HCl in 0.05 N oxalic acid with an equilibration period of 30 minutes and soil solution ratio 1: 10 as a better method for estimating the total, available phosphorus (Ra-value)

#### **Physical properties of soil**

##### *Studies on the variation of Redox potential of rice soil in the organic-inorganic system of rice fertilization (Pattambi)*

The project was started by recording the 'eh' values *in situ* at 10-12 days interval from the treatment plots in the existing permanent manurial experiments with a portable Redox meter. The trial was conducted only during the virippu season. A general decrease in the potential with period of flooding was noticed. In green leaf and cattle manure plots, intense reduction was observed comparatively earlier than in the case of the treatment plots.

##### *Aggregate size distribution and its relationship to physical and chemical properties of some typical soils of Kerala*

In order to have an idea of the structural status of the typical soils of Kerala and its relationship to physical and chemical properties, this experiment was conducted. Sample collection was commenced. Literature available on similar lines of work were collected.

*Water availability periods for crop planning under rainfed conditions of Kerala (Vellanikkara)*

The water availability periods, moist period I, moist period II and humid periods are worked out for the five IMD Stations on the basis of climatic data from 1931–1960 which is published by the IMD.

*Studies on ground water fluctuations and quality of water in the Farm, Agronomic Research Station, Chalakkudy (Chalakkudy)*

The water table fluctuations and quality of ground water of the Farm, Agronomic Research Station, Chalakkudy were determined during the last three years. During the year under report, in the low land, water table was found to fluctuate from 1.7 cm to more than 200 cm below the ground level, whereas in the upland, the level varied between 11.5 cm and 200 cm below ground level. In the case of garden land, the ground water table fluctuated between a minimum of 51 cm to a maximum of 200 cm. The analysis of water samples collected from the piezometers at periodical intervals indicated that the quality of water was satisfactory. Nitrate, carbonate and sulphate were absent in the water samples tested. Bicarbonates and chlorides were present in estimable concentrations; but both remained much below the toxic limits. Iron was present in a few of the samples tested, pH was around 6.0–6.8 and the conductivity ranged between 0.1 and 0.4 mmhos/cm.

*Water balance studies of Kerala (Vellanikkara)*

Climate–water balance studies were conducted in five stations—Trivandrum, Alleppey, Cochin, Palghat & Calicut. The different water balance parameters such as water surplus, water deficit and actual evapotranspiration were graphically represented.

*Studies on the moisture relation characteristics of laterite soils of Kerala (Vellanikkara)*

The study aims at working out the soil moisture tension–content relationship of laterite soils of Kerala. The soil moisture tensions are 0.3, 1, 5, 10 and 15 bare. The retention characters will be related to the contents of five fractions and organic matter in soil.

**Soil organic matter – compost making**

*Rate of decomposition of salvinia as influenced by chemical agents (Vellanikkara)*

In order to screen chemical agents suitable for hastening the decomposition of salvinia mechanically removed from water bodies, an experiment was conducted.

*Characterization of soil organic matter in different soil types of Kerala (Vellanikkara)*

The objectives are to examine the composition of soil organic matter in the surface soils of the different soil types of Kerala and to

study the relationship between soil organic matter and soil nitrogen so as to establish more precise regression equation for calculating the total and available nitrogen in soil based on organic matter and organic carbon content of soils.

500 soil samples from different parts of the state representing different soil types were collected for the study. The chemical analysis of the samples and the fractionation of the soil organic matter were in progress.

### **Pollution hazards**

#### *Impact of industrial effluents on crop hazards in the coastal sandy soils of Trivandrum (Vellayani)*

The objective is to study the nature and severity of pollution and related aspects with a view to suggest ameliorative measures. The work has been started. Periodical analysis of soil and water samples collected from the locality was attended to.

## **FARM ECONOMICS, EXTENSION AND STATISTICS**

### **CONCLUDED PROJECTS**

#### **Farm Economics**

##### *Income pattern of farm families (Vellayani)*

The study revealed that agricultural income contributed to only 38.98 percent of the total income. Further, as the size of the holdings increased, the share of non agricultural income in the total farm income decreased. On an average, 58.93 percent of the total agricultural income was derived from crops, the remaining 41.07 percent contributed by livestock. It was found that the contribution from livestock increased as the size of holdings diminished. Coconut was a predominant crop contributing to 78.45 percent of the income from crops.

##### *Marketing of Agmark products in Trivandrum district (Vellayani)*

The commodities marketed under Agmark were coconut oil, gingelly oil, honey and ground spices (turmeric, coriander and chillies). Lack of information on the quality of Agmark products as well as the high prices were found to be responsible for the low demand for graded products.

##### *Cost of cultivation and economics of paddy in Kerala 1978-79 (Vellanikkara)*

The cost of cultivation of paddy per hectare, the cost of production per quintal of grain and the cost benefit ratios for the districts selected

are given below both for high yielding and traditional varieties.

District	Cost of cultivation (Rs/ha)		Cost of production of grain (Rs/q)		Cost benefit ratio	
	78-79	79-80	78-79	79-80	78-79	79-80
<i>High yielding varieties</i>						
Palghat	1742.73	1847.61	59.96	42.92	1.69	2.18
Trichur	2240.34	2249.89	79.71	52.88	1.32	1.64
Alleppey	2722.44	2889.11	84.06	79.63	1.27	1.32
<i>Traditional varieties</i>						
Palghat	1680.33	1724.51	87.41	66.63	1.25	1.55
Trichur	1905.07	1938.47	107.14	93.60	1.12	1.14
Alleppey	2059.42	2959.54*	98.60	100.86*	1.12	1.17

(\* improved varieties)

*Economics of sugarcane cultivation in Chittur area of Kerala State: A pilot study (Vellanikkara)*

The cost of cultivation per hectare involved in growing sugarcane has been worked out. The informations were collected for plant crop and ratoon. The total cost per hectare for the plant crop, ratoon and combined is given below. Cost of production per tonne of sugarcane and cost benefit ratios are also presented:

	Cost of cultivation (Rs/ha)	Cost of production of sugarcane (Rs/t)	Cost benefit ratio
Plant	6299.29	75.69	1.72
Ratoon	5632.48	81.52	1.59
Combined	11931.77	78.33	1.66

**Extension**

*Studies on the role of National Demonstrations in the adoption of improved agricultural practices by farmers (Vellayani)*

The study was conducted in Trivandrum district among the farmers who have conducted National Demonstrations organised by Farmers Training Centre, Trivandrum. It was found from the analysis of the data that the adoption rate of agricultural practices such as HYV seeds, transplanting, fertilizer application and use of insecticides increased in the case of demonstrator-farmers.

*Influence of leaders in the development of rural areas (Vellayani)*

The study conducted in a progressive and a non-progressive villages in Quilon district revealed that the adoption leaders in the progressive village were superior as disseminators of agro-information.

Majority of them acted as co-ordinators in the process of agricultural development. In the non-progressive village, majority of the leaders were less progressive with medium level of innovation behaviour.

*Relative effectiveness of selected extension methods in imparting knowledge on food and nutrition among the rural and urban beneficiaries of nutrition programme (Vellayani)*

Among the three extension methods employed, lecture, followed by method demonstration was found to be the most effective method of imparting knowledge on food and nutrition.

*Effectiveness of training programmes for farmers (Vellayani)*

The study was conducted in six selected Intensive Paddy Development units of Palghat district. It was found that the trained farmers had significantly higher mean scores for education, social participation, farm power, extension orientation, level of knowledge and extent of adoption.

*A study on the role of rural youth in the agricultural development of rural areas (Vellayani)*

The study was conducted in Pattambi N. E. S. Block of Palghat district. The youth Club members ranked "helping in the non-formal education programmes for farmers" as their most important role and "action participation in the extension activities organised by the extension staff in Agriculture" as the most often performed role.

## **ONGOING PROJECTS**

### **Farm Economics**

*Over dues of short and medium term credit of co-operative credit institutions: Trivandrum district (Vellayani)*

The percentage of arrear outstanding in the case of small and big farmers were found to be 41.16 and 42.15, respectively. In the case of medium term loan, the percentage of arrear outstanding was 6.8.

*Evaluation of SFDA, Trichur, (Vellanikkara)*

The functions of SFDA, Trichur were evaluated.

*Resource use efficiency in paddy cultivation in Kuttanad (Vellanikkara)*

The objective is to work out the cost of cultivation, economics and the efficiency of resource use in Kuttanad for paddy cultivation.

*The production and marketing of milk in Trichur district (Vellanikkara)*

The cost of maintenance and economics of maintaining milch cows were worked out.

*Economics of rubber cultivation in Kottayam district (Vellanikkara)*

The objective of the study is to evaluate the cost, return and resource use efficiency, and to study the problems of rubber growers in Kottayam. The work is in progress.

## **Statistics**

### ***Futurology studies (Vellayanti)***

Under the scheme, it is intended to build up a data bank and utilise the information for prediction of population, requirement of agricultural inputs, production of crops and other allied aspects. Building up of the data bank is in progress.

### ***Uniformity trials on vegetable crops (Vellanikkara)***

First experiment on brinjal is being conducted and the data are being collected. Data on different vegetable crops are to be taken by conducting separate experiments.

### ***Trends in production of various crops (Vellanikkara)***

Different time series models for describing the trends in production of various crops are being worked out.

### ***Crop weather correlation studies utilising the available data at the Rice Research Station, Pattambi (Vellanikkara)***

A significant positive correlation was noted between monthly rainfall during June and yield of paddy for one variety during autumn season. There was significant positive correlation between the number of rainy days during October and yield of one variety of paddy in the winter season. Among the various weather parameters tried, monthly rainfall accounted for maximum variations in yield of the autumn crop.

### ***Determination of optimum plot size for banana and vegetable crops (Vellanikkara)***

The optimum plot size for trials with banana has been estimated. Studies on the optimum plot size for various other crops like bitter gourd and pumpkin are in progress.

### ***To study the genetic diversities of the different banana varieties and to make use of them in exploiting heterosis by hybridisation (Vellanikkara)***

Data have been collected and the analysis is in progress.

## **SOIL CONSERVATION & MECHANISATION**

### **ONGOING PROJECTS**

#### ***Preliminary studies on mechanical control of aquatic weeds (Vellanikkara)***

A prototype *Salvinia* harvesting machine consisting of two 5 H. P. pumpsets and an ejector system mounted on a specially designed floating platform was fabricated. The testing work of the machine was carried out.

#### ***Mechanical control of *Salvinia molesta* (African payal)***

A 10 HP prototype *Salvinia* harvesting machine developed and fabricated under another project was tested at three different locations (Chettupuzha in Trichur district, Moncompu in Alleppey district and



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Kumarakom in Kottayam district). The extensive tests carried out indicated that the machine is capable of harvesting one hectare of *Salvinia* at an average spread density of 150 t/ha, in 10 working hours. This in turn gave an average harvesting capacity of 15 t/hr for the machine.

*Development of a light weight garden tractor (Vellanikkara)*

The development of a light weight garden tractor was taken up under this project. The tractor utilized a 5 H. P. Lombardni engine as the prime mover. The transmission consisted of belt-pully, sprocket and chains. The unit weighed approximately 125 kg and was found to give satisfactory performance in 25 hours of endurance testing with a  $\frac{1}{2}$  ton trailer.

*Development and evaluation of a light weight garden tractor and attached implements (Vellanikkara)*

Several implements were adapted or designed to work in conjunction with the garden tractor developed in another project. The implements included a mould board plough, a Japanese type plough, a cultivator, a disc harrow, a straight bundformer, a ring bundformer and a  $\frac{1}{2}$  ton trailer. Among the attachments, the ring bundformer is an implement of original design by the Department which can be effectively utilized for taking ring bunds around coconut trees. The testing work on the garden tractor with the various implements are in progress.

*Studies on small scale equipment for wet processing of coconut (Vellanikkara)*

One of the unit operations to be performed in the wet processing of coconut is the grating of the coconut meat. In the present study different designs of grating tools were evaluated by the use of variable speed motor which could be operated at any desired speed. The study indicated that a grating tool designed by the Tropical Products Institute, U. K. gave the best performance and that a speed of 700-800 rpm would be most ideal for motorized grating.

*Design and development of vegetable seed drier (Vellanikkara)*

In this project, several samples of chilli, brinjal, capsicum and ashgourd seeds were dried in a low cost drier fabricated for the purpose. Studies were conducted at four temperature levels and germination tests were also carried out to find out the optimum temperature at which each seed is to be dried. Other suitable designs of drying equipment are also tested for its functional performance.

*Adaptive design and development of local innovations (Vellanikkara)*

A single row push type seed drill was fabricated. The design was adapted from those developed at IRRRI and TNAU.

*Utilization of aquatic weeds (Vellanikkara)*

Different designs of pilot plants for biogas production from *Salvinia* were taken up during the year

### *Application of jet pump for low lift irrigation (Vellanikkara)*

The self propelled canal pumping unit developed from conventional irrigation pumpsets and jet pump attachments mounted on a floating platform was extensively tested both as a low lift pumping unit and as a *Salvinia* harvesting machine. The pumping performance indicated that while individual pumps gave a best efficiency capacity of 500 l/min, the combined discharge obtained from the combination as a canal pumping unit was of the order of 2000 l/min. Thus the unit had achieved a multiplication ratio of 1:4.

### *Utilization of African payal for biogas production (Vellanikkara)*

As part of the preliminary studies in the project, physical and mechanical properties of the *Salvinia* weed are being investigated. The properties to be investigated are moisture content, bulk density, permeability, compressibility, and consolidation and strength characteristics. Experimental equipment for the determination of these properties are being designed.

### *Development of small scale dredging equipment (Vellanikkara)*

In this project it is proposed to utilize the *Salvinia* harvesting machine as a small scale dredging equipment also by incorporating suitable modifications. It may be noted that at present, river sand is being collected manually by diving into the water. It is hoped that drudgery of this work could be minimized by the use of this equipment.

### *Development of portable axial flow pump (Vellanikkara)*

Low lift pumping is at present carried out manually by the use of water wheels or mechanically by the use of large H. P. "petty and para" units. Both these equipment are highly cumbersome to operate. In this project, it is proposed to develop a 5 H. P. portable axial flow pump similar to those being used in South East Asian countries. The design drawings have been collected from IRRI and the fabrication work is in progress.

### *Hydraulics of border strip irrigation (Vellanikkara)*

This aims at investigating the feasibility of border strip irrigation in the relatively level rice fields during the summer season. Initial trials in this regard has yielded encouraging results.

### *Establishment of prototype feasibility test centre (Vellanikkara)*

This is an ICAR sponsored scheme. Under this scheme, several hand pumps have been collected from outside the State for evaluation. A test facility consisting of two above level ground tanks have been constructed. Popular designs of seed drills have also been collected for evaluation.

## **CROPPING PATTERNS & FARMING SYS EMS**

### **CONCLUDED PROJECTS**

#### *Intercropping trials with annual crops (Pilicode)*

The study has been conducted to find out the effect and economics of cultivation of various annual crops in the interspaces of coconut garden. Elephant foot yam, tapioca and ginger were profitable, while turmeric and colocasia brought about net loss. From the results obtained for three years, it has been found that though all crops gave satisfactory yield, the net return varied due to the fluctuating market price.

#### *Intercropping coconut garden with different varieties of banana (Pilicode)*

Among the five varieties of banana tried under coconut shade, robusta and nendran were found to be more economic. The cost-benefit ratio in respect of these two varieties worked out to be 1.77. Palayan-kodan was the next best. Results of the previous years are also in conformity with the present results.

### **ONGOING PROJECTS**

#### *Input requirement of rice based cropping pattern (Chalakudy)*

The objectives were to assess the yield response of rice at different levels of NPK, to find out an economic dose for rice under different cropping sequences, to estimate input reduction possible in each season and to work out the cost-benefit ratio for the cropping patterns. It was observed that during 1980-81 first crop season, normal dose, 75% of the normal dose and 50% of the normal dose of NPK were on par. But during the second crop season, only normal dose and 75% of the normal dose of NPK were on par. These were significantly superior to 50% of the normal dose of NPK. The cropping sequence and its interaction with the levels of NPK were not significant.

#### *Varietal-cum-fertilizer studies on pepper grown as an intercrop in coconut garden using coconut palm as standard (Balaramapuram)*

The objectives are to screen out the most suitable pepper variety for intercropping in coconut garden and to work out the suitable fertilizer schedule for pepper grown as intercrop in coconut garden. The experiment was laid out in RBD with eight treatments in August 1980.

#### *Studies on banana based cropping pattern-Intercropping banana with tapioca, groundnut, cowpea and bittergourd (Mannuthy)*

The objective of the experiment was to explore the possibilities of raising various intercrops such as tapioca, groundnut, cowpea and bittergourd in banana gardens and to find out the best crop combination.

#### *Experiment on multiple cropping (Moncompu)*

Among the different crops grown after punja crop, cowpea was found to be ideally suited as a catch crop followed by blackgram. In the subsequent crop season (additional crop), highest grain yield was obtained from plots where cowpea was grown during summer (punja season).

*Effect of crop rotation on the growth and yield of banana var. nendran (Kannara)*

To find out the best crop rotation for banana variety nendran, an experiment was initiated with four treatments and five replications, in a three year crop rotation. Second year of the trial is over and the crops were harvested and yield recorded.

*Standardization of cropping system for banana var. nendran (Kannara)*

The objective is to find out the most economic cropping system for banana and pineapple. During the year, the trial with banana was taken up. The intercrops planted in the banana trial were colocasia, amaranthus, bhindi, cucumber, cowpea and chillies.

## VETERINARY AND ANIMAL SCIENCES

### CATTLE AND BUFFALOES

*Relationship of blood constituents in heifers to their future milk producing ability*

On statistical analysis of the data of the individual blood elements no significant relationship was noticed between them and the milk yield. Multiple correlations of the various blood elements are being worked out to find out the relationship to milk production.

*Some aspects of physiology of lactation*

The results indicated that induction of lactation by injection of hormones can be practiced to utilise the production potentialities of superior but infertile cows and heifers. The animals gave milk of normal composition after hormonal induction and the process helps regain normal fertility in the animals after the treatment.

*Determination of solids-content of milk by specific gravity Lactometer*

The data revealed that no correction factor was necessary for the values of total solids obtained by using Ling formula. The value obtained are in agreement with those obtained by the gravimetric method in respect of all the samples of milk.

*Composition of milk of cross bred cattle*

The data so far collected indicated that the values for fat, protein, lactose and ash ranged from 1.6 to 9.5, 2.3 to 5.4, 2.5 to 5.7 and 0.2 to 0.9 percent respectively.

*Chemical constituents affecting osmolality of milk in cross bred cattle*

The values for sodium, potassium, chloride and lactose in the milk of cows in early, middle and late lactation as well as of those under induced lactation and those with mastitis were collected at intervals of seven days for detailed studies.

#### *Utilisation of paddy straw treated with urea and molasses as cattle feed*

Poddy straw treated with 2% urea and 10% molasses was found to be palatable for cattle and could sustain adult animals and promote growth in calves with limited concentrate. Lactation studies with the material are in progress.

#### *Poultry litter as cattle feed*

Poultry litter was found to contain 16% protein and 2.15% calcium. Assessment of the nutritive value of the material in cattle was in progress.

#### *Comparative feed conversion efficiency of cross bred Jersey and cross bred Brown swiss cattle for growth*

Growth studies involving eight cross bred Jersey female calves and eight cross bred Brown Swiss female calves were in progress. Data on fortnightly body weight, feed intake, body measurement and haematological values were collected.

#### *Nutritive value of complete (all concentrate) rations for cattle (1) Based on coir waste*

Seven all concentrate rations with different levels of coir waste were tried on bull calves and on adult bulls. Consistent consumption was not obtained with rations containing 50% coir waste and therefore the percentage of coir waste was reduced to 30% in rations to make the ACR more palatable. Further studies showed that a fibre content of 15.4% in ACR was optimum for normal functioning of the rumen.

#### *Comparative feed efficiency of cross bred Jersey and cross bred Brown Swiss cattle for milk production*

Lactation studies involving 12 cross bred Jersey cows and 12 cross bred Brown Swiss were in progress. Data on feed intakes, milk yield, composition of milk and haematological values were collected.

#### *Lucerne meal as an ingredient in calf starter*

No significant difference in the growth rate of animals was observed between the three groups, though the animals in the control group had slightly higher gain in body weight. All the animals in the three groups maintained normal blood values. No significant difference was noticed in the body measurements of animals in the different groups. The results indicated that lucerne meal could successfully be incorporated in the calf starter ration upto 20 per cent without any adverse effect either on growth or on the nutrition of the animals.

#### *Feeding values of fresh cocoa husk for growing calves*

Fresh cocoa husk on analysis was found to contain 17.31% dry matter, 7.80% crude protein, 2.26% ether extract, 35.11% crude fibre, 47.58% nitrogen free extract, 7.25% ash, 0.63% calcium and 0.17% phosphorus on dry matter basis. Palatability studies conducted in farm

animals showed that the material is highly palatable and animals consumed upto 0.82 per cent of their body weight. The average digestibility co-efficients of nutrients in cocoa husk were found to be, dry matter  $72.86 \pm 3.47$ ; organic matter,  $60.97 \pm 1.25$ , crude protein  $84.50 \pm 2.69$ ; crude fibre  $45.54 \pm 3.18$ ; ether extract  $48.72 \pm 2.57$  and nitrogen free extract  $80.35 \pm 6.42$ . On dry matter basis, the material had a DCP of 6.6 and a TDN of 63.28 per cent.

*Effect of pepper waste on intake and digestibility of all concentrate ration based on coir waste*

The palatability of the material being poor, it offered no promise of being included in the ration replacing conventional feed ingredients. Since pepper is well known as a stomachic, the appetising effect, if any, of the material was studied by adding the same to all concentrate ration fed to bull calves. It was concluded that pepper waste can be used to enhance the intake of all concentrate rations without affecting the digestibility of nutrients.

*Studies on the environmental physiological response of cross bred animals at the Cattle Breeding Farm, Thumburmuzhi*

Linear body measurements were higher in the control group of animals. The age at first heat was 405 days, while in the experimental animals it was 596 days. During the year under report, March was the hottest month.

**GOATS**

*The birth weight and growth rate of Malabari and crossbred kids*

Sex of the kid, type of birth and weight of dam at kidding had highly significant effect on birth weight of kids. Adjusted average for body weights at different age showed a definite linear increase in body weight as the age advanced.

*Genetic studies on immunoglobulin level in goats and its association as its survivability*

The mean pre-colostral immunoglobulin (Ig) level was found to range between zero and 0.94 mg/ml. After ingestion of colostrum, the level rose to 73.588 mg/ml in 17.36 hrs. After this peak the level was found to decline upto 25.328 mg/ml by 6-7 weeks and thereafter it showed an upward tendency. The genetic group had significant effect on post colostrum peak; the level being 76.940, 69.783 and 60.067mg/ml respectively for Saanen x Malabari, Saanen x Alpine x Malabari and 75% Saanen. Kids died during the first two months had significantly lower (56.771 mg/ml) Ig level than surviving kids (73.588 mg/ml). Single kids born showed 78.014 mg/ml where as twins and triplets had only 75.009 and 61.441 mg/ml, respectively.

#### *Inheritance of certain qualitative traits in goats*

Colour pattern of 700 Malabari goats purchased as well as born in the farm were recorded and it was found that 40 per cent was solid white, 29 per cent solid black, 24 per cent solid brown, 5 per cent roan and 2 per cent grey.

#### *Inheritance of threshold characters in goats*

Data on the mortality among kids maintained at All India Co-ordinated Research Project on goats at Mannuthy for the period from 1974 to 1982 was analysed. Out of 865 mortality recorded, 504 (50.30 per cent) were kids below 15 days of age. Decline in mortality was noticed as the age advanced. Maximum mortality occurred in kids born in the rainy season.

#### *Detailed studies on reproductive performance of Malabari goats*

Collection of data on reproductive performance like age and weight at first kidding, gestation period, service period and inter kidding interval was completed.

#### *Production performance of Malabari goats—Standardisation of phenotype—Studies on factors influencing them*

Collection of data on production traits such as total milk yield, milk yield per day of lactation and per day of kidding interval was completed.

#### *Serum immunoglobulin in Alpine × Malabari kids and its association with growth and mortality*

Blood samples from 52 kids were collected and the immunoglobulin level was determined. Actual immunoglobulin level will be determined after preparing a standard curve.

### **POULTRY AND DUCKS**

#### *Inheritance of chick weight and egg production in three strains of white leghorns and the relation of chick weight to egg production*

Chick weight at six weeks and eight weeks was recorded on 4000 birds belonging to three generations. Age at first egg, egg weight and egg production upto 200 days of age were also recorded on individual birds. The data on one more generation is to be collected before statistical analysis.

#### *Histochemical studies on the skeletal muscle of the duck*

Muscle samples of embryos and ducklings were collected for histochemical studies. Studies on three groups of ducklings have been completed. Histochemical and histological studies on the flight muscles and leg muscles are in progress.

#### *The structure and development of the digestive system of the duck*

Duck embryos collected at varying intervals of time during incubation were subjected to histological studies.



### *Inheritance of chick weight and egg production in three strains of White Leghorns and their inter relationship*

Three strains of White Leghorns, namely, P, N and F were used in the study. Chick weight at six weeks and eight weeks have been recorded for 4000 birds belonging to the above three strains. Age at sexual maturity, egg production upto 200 days of age and egg weight have also been recorded. The records relating to three generations have already been collected and those relating to the fourth generation is being collected.

### *Effect of added fat on broiler performance*

Three different sources of fat, namely, tallow, lard and rice bran oil at levels of 6, 9 and 12 per cent were evaluated in the broiler ration. The broiler birds were maintained on these types of diet till market age (8 weeks). The records of body weight, feed consumption and carcass data have been collected.

### *Comparative study on the fractionation of lipids and proteins of eggs from duck and hen*

The fractionation of protein in the eggs from hen and duck revealed that the albumen from hens' egg had two albumen fractions and three globulin fractions, whereas the duck egg albumin had only two fractions each of albumen and globulin. Albumen fraction of hen's egg had a mobility of + 2 cm and constituted 21.17% of total albumen. Season had no influence on the distribution of the protein fractions of eggs from hen as well as ducks.

### *Lipid transfer in chicken ovary*

The biochemical estimations of lipids and related compounds in the liver and ovary of chicken were in progress. The biological study on the influence of injecting sex hormones in these chemical entities in mature and immature chicken was also in progress.

### *Studies on the metabolic activity of avian ovary*

The ovary from White Leghorn birds belonging to the age groups of 1-2 months, 2-3 months, 3-4 months, 4-5 months and adult layers were subjected to analysis of biochemical components like phospholipids cholesterol etc., for understanding the metabolic activity of this organ. The standardisation of the biochemical procedures for preliminary work connected to the study of histochemistry of ovary have been completed.

### *Establishment of nutrient requirements of ducks*

The project envisages to estimate the metabolizable energy content of locally available feed ingredients that are commonly fed to ducks. Fifteen cakes were employed for the biological assay procedure. Ground-nut cake, gingelly oil cake, coconut cake, yellow maize, tapioca, rice bran and wheat bran were the ingredients tested. The biological assay has been completed.

### *Studies on seasonal quality of chicken eggs*

Two hundred eggs were subjected to study during each season. The results indicated that the external egg quality traits like egg weight and shape index are not influenced by season. The internal quality parameters showed considerable variation among seasons of the year, best being during the period from June to February. The quality was poorest during hot season (March to May). This study pointed out the possibility that the quality deterioration of eggs produced in rural areas of Kerala are likely to be of higher magnitude, since the eggs are held for some time before they are sold or used.

### *Studies on the quality of duck eggs with special reference to shell quality*

One hundred duck eggs collected from the University Duck unit and 170 duck egg procured from the field were studied. Eggs of ducks reared on free range system were comparatively heavier than those obtained from ducks reared under semi-intensive system. Both shell and shell membrane thickness were more in eggs from ducks reared in semi-intensive system.

### *Evaluation of purebred White Leghorn, Rhode Island Red, Australorp breeds and their crosses*

The White Leghorn, Rhode Island Red and Australorp breeds of chicken in the University Poultry Farm were under pure line selection studies. The second generation of White Leghorn has been produced during 1980-81 and 400 birds have been chosen as breeders for the third generation. One hundred and twenty each of Rhode Island Red and Australorp have also been chosen as breeders. The productivity has been recorded.

### *Studies on certain economic traits in desi ducks*

The data revealed that the production trend in desi ducks was very erratic in contrast to the smooth up-swing and down-swing seen in chicken. There were two peaks seen in the production curve: one during July-August and the other during November (two rainy seasons in this state). Thus a possible relation between the effect of season on the egg production trend has been indicated. Even though the production is erratic, they showed a potentiality of production of around 60 per cent. The results obtained in the preliminary cross breeding studies indicated that all production traits studied showed a positive response in cross bred progenies.

### *Trace mineral content of poultry feed ingredients-Manganese*

Twenty samples each of groundnut cake, gingelly oil cake, wheat bran, rice bran, tapioca, yellow maize and unsalted dried fish were taken up for evaluation. The trend of the results suggested that barring tapioca most of the feed ingredients have fairly high concentration of manganese.

### *Replacement value of liver meal in layer ration*

Two hundred and fifty White Leghorn pullets were assigned to five dietary regimes where the dried fish in the ration was replaced at 0,25, 50, 75 and 100% by liver meal. Each dietary treatment had three replicates and each replicate, 10 birds. Data on egg production, feed consumption, egg weight and egg quality were collected.

### *Keeping quality of shell eggs during summer*

During the period under report, 144 shell eggs were held under above holding conditions and the quality deterioration after the 3rd, 5th, 7th and 15th day of holding was studied with the eggs held during March 1981. Similar procedures will be adopted during the months of April and May 1981.

### *Evaluation of an economic layer ration evolved at the Central Institute of Fisheries Technology*

The results indicated that the layer ration developed by the CIFT was inferior to the control in terms of egg production, hatchability and feed efficiency. Egg quality traits were not different between the two treatments. It was therefore concluded that though the cost *per se* of the CIFT layer ration was less, it is not capable of bringing about economic returns.

### *Field trials with pure bred and crossbreds to identify a bird for backyard*

Eight homesteads in Always Settlement Scheme, Always were chosen and three types of crossbred chicken (ALP x WLH, WLH x ALP and RIR x WLH) have been taken up for test. The birds are yet to come into lay.

### *Evaluation of pure bred and crossbred chicken under backyard condition*

The work is to be taken up at Kanjicode (Paighat). The homesteads have been selected. Chicken belonging to White Leghorn, Rhode Island Red, Australorp and their crosses were distributed among 45 homesteads in such a way that each homestead will receive only one genetic group. Each genetic group will have five replications, with five layers each. The distribution of birds was done on 25-2-1981. Data collection will be started as soon as the birds come into lay.

## **PIG AND OTHER ANIMALS**

### *The effect of inbreeding on certain economic traits in swine*

The inbreeding depression on different economic traits like litter size at birth and weaning percentage, litter weight at birth and weaning were collected from 290 piglets born out of 35 farrowings of LWY pigs. A decline in litter size at birth with an increase in inbreeding percentage was observed. The study indicated the undesirable effect of inbreeding on economic traits in swine.

### *Inheritance of gammaglobulin level in swine and poultry*

Blood samples from 20 pigs have been collected for detailed studies.

### *Growth and carcass characteristics of pigs maintained on rations containing different levels of dried tapioca chips.*

The studies indicated that dried tapioca chips can be incorporated in the rations of growing and finishing swine at a level of 47% in place of concentrate cereal meal like maize in as much as, almost similar growth rates and feed conversion efficiency were obtained with three isoprotenic diets containing 0, 20 and 40 per cent levels of dried tapioca chips in partial or complete replacement of maize.

### *Potentialities of indigenous pigs of Kerala*

Growth rate of indigenous pigs were found to be just half that of exotic pigs. With regard to other characters like feed efficiency and carcass characteristics, there was not much difference.

### *Pig rearing based on utilization of frog-leg trimmings in the farmers' fields.*

The frog leg trimmings were utilized with minimum addition of other ingredients and treatments, for pig rearing. The post weaning and eviscerated carcass weight and dressing percentage of pigs were observed. The chemical composition of frog-leg trimmings was also found out. It contained 57.4% crude protein on dry matter basis and is an excellent source of animal protein.

### *Effect of inbreeding on certain economic traits of swine*

Inbreeding showed an undesirable effect on litter size at birth and at weaning and litter weight at birth in large White Yorkshire pigs. The studies indicated that for improvement of swine, a breeding programme may be drawn avoiding inbreeding to obtain favourable results with regard to pre-weaning economic traits in Large White Yorkshire pigs.

## ARTIFICIAL INSEMINATION AND ANIMAL REPRODUCTION

### *The efficiency of intra-uterine administration of antibiotics to improve breeding efficiency in cows*

The studies were carried out in two groups. In the first group, "Dicrysticin-S" was used and in the second group "Mastalone-U2" was tried. The conception rates in the experimental groups were high as compared to the controls; but no significant difference was noticed between the two experimental groups. It was concluded that antibiotic therapy of uterus, 24 hours after insemination would improve conception rate under field conditions.

### *Progesterone administration for improving the conception rate in dairy cattle*

Administration of progesterone (5-10 mgm) immediately after A. I. of every alternate cows was practiced in the University Livestock Farm,

Mannuthy. Out of 67 cows (experimental) which received the progesterone administration immediately after AI, 33 (49.25%) conceived. In the control group of 68 cows which did not receive any treatment, 30 cows (44.1%) conceived. Since the conception rate in the experimental group was higher than the control group, trial on wider scale was conducted in the A. I. centre. The data on these are being collected and analysed.

#### *Age of semen and conception rate in goats*

Inseminations using buck semen diluted in goat milk extender and stored for different periods (upto 48 hours) were carried out. Results of the study showed that conception rate of buck semen in goat milk extender showed a significant decline as the age of semen increased beyond 24 hours of storage. The conception rate for "storage upto 24 hours" was 42.78%.

#### *Estimation of success of artificial insemination in terms of fertility*

A total of 7,35,303 inseminations were conducted and a total of 3,06,300 animals were followed up. Total number of success in terms of pregnancy were 1,41,140 making up a percentage of 46.1. Total number of calves born were 96,170 (31.4%).

#### *The incidence, nature and magnitude of the prevalence of infertility conditions among crossbred cattle of Kerala*

Investigations conducted so far revealed that the major problem encountered at Mavelikkara and Calicut were delayed maturity in heifers. Anoestrus was found to be the major problem affecting both cows and heifers. In heifers, anoestrus was due to under developed genitalia. Ovarian hypoplasia was found to the extent of 0.72% (bilateral) and 2.18% (unilateral). The left ovary was most affected. Cystic ovary was found to the extent of 0.04%. Other conditions causing infertility were cervicitis, metritis and endometritis. One case of vaginal tumour was detected in a cow.

#### *Utero tubal insufflation test as an aid in the diagnosis and treatment of tubal impotency in repeat breeder cows*

Forty two caprine genitalia were subjected to the test and the study revealed only unilateral and bilateral impotency in 4.76% and 2.39% genitalia respectively. The safety margin was very high and hence the test can be used as a reliable one. On the basis of the study on excised genitalia, the test is recommended for adoption in infertile animals.

#### *Synchronisation of oestrus and artificial insemination in breeding swine*

The object of the scheme was to synchronise oestrus in sows by exogenous dry administration so that many sows in a farm can be bred in the same day. Synchronisation and A. I. go a long way in the progress of swine industry. The first part of the scheme-synchronisation of oestrus could not be carried out due to non availability of prostaglandin  $PGI_2$ .

which has to be imported. The second part-artificial insemination trials were carried out to evolve a suitable diluent for boar semen. Six diluents viz., Kiew-I, Kiew-II, Glucose Glycine EDTA Soda bicarb Citrate, CMFEYGC and IVT were found to preserve boar semen satisfactorily upto 60 hrs. Among these, the first three were found superior to the other three. In addition, it was observed that preservation was better at 15°C than at 5°C.

*Effect of early post partem breeding on the reproductive efficiency of cross bred cows*

The percentage of conception with single and with three or less services in cows bred between 30-45, 46-60 and above 60 days were 50-71%, 75-100% and 50-75%, respectively. The percentage of non breeders and abortions were 28.57 and 7.40 respectively in 30-45 day group and 16.60 and 8.33 for cows bred after 60 days. There was no incidence of non-breeders and abortions in cows bred between 46-60 days. The lactation yield (305 days) of the cows conceived in the 1st group was 1674.539 kg, in the group II, 701.16 kg and Group III, 614.63 kg. Analysis of the data showed no significant difference in any of the traits among the three groups.

*Investigation in vibriosis in cross bred cattle of Kerala*

Animals having the history of natural service brought for insemination at the A. I. Centre, Mannuthy, were screened. 149 samples were subjected to microscopical examination of vaginal mucous and 38 samples at random were examined. The above screening did not reveal the presence of vibriosis.

*Infertility due to Trichomoniasis*

The object of the study was to investigate the incidence of Trichomoniasis and to standardise the diagnostic procedures. Fifty animals were screened by examining the vaginal mucus for the presence of Trichomoniasis organisms and no positive case was recorded.

*Observation on the gestation and parturition in goat*

Gestation length did significantly vary between breeds in single and multiple birth. Parity of the dam did not have any influence on the gestation length. Similarly the gestation length was not influenced by the sex of the kid. The length of gestation during summer, rainy and winter was  $146.48 \pm 0.27$ ,  $146.95 \pm 0.31$  and  $147.10 \pm 0.33$  days, the variation being non significant. The percentage of single, twin and multiple births was observed to be 50.74, 45.05 and 4.9 respectively. The rate of kidding was more (69.44%) during the day and less during night (30.6%).

*Post partem reproductive performances of cross bred cows*

The cows gaining in weight during post partem showed post partem oestrus in  $48.53 \pm 3.35$  days and those losing weight in  $74 \pm 7.86$

days. This variation was statistically significant. The service period of cows gaining in weight was 77.89 days and that of losing weight was 70.38 days. Early breeding of cows before 60 days post partem yielded high fertility without affecting the milk yield and thus reducing the service period and calving interval.

#### *Reproductive performance of cross bred heifers*

The length of oestrous cycle ranged from 18 to 22 days with an overall mean of 19.5 days in the cross breeds studied. The duration of oestrus ranged from 8 to 25 hours with an overall mean of 16.97 hours. Ninety two percent of cross breeds exhibited pronounced heat and 8 per cent medium signs. None showed weak signs of heat. Majority of ovulation occurred at about 8 to 20 hours after the end of oestrus. Incidence of ovulation was found to be 12.5 and 7.4 per cent in 50 per cent and 62.5% Brown Swiss crosses and 3.03 per cent in 50% Holstein crosses Jersey crossbreeds did not show ovulation. An overall incidence of 6 per cent metoestrous bleeding was observed in the cross breeds. The incidence was higher in 50 per cent Holstein and lower in 62.5 percent Jersey crosses. 62.5% Jersey crosses had the lowest and 50% Holstein had the highest birth weight. Jersey cross attained puberty at an earlier age and Brown Swiss cross bred took the maximum time. 62.5% Jersey cross breeds had the lowest weight at puberty and highest in 50% Holstein crosses. 62.5% Jersey had the lowest age at conception and highest in 50% Brown Swiss. 62.5% Jersey crosses had the lowest weight at conception & 50% Holstein highest weight.

Length of oestrous cycle differ significantly between breeds, the mean being 19.56 days. Duration of oestrus did not significantly vary between breeds, the mean value being 16.97 hours. Majority of cross breeds showed pronounced heat. Ovulation occurred 8.10 hours after the end of oestrus. Jersey cross breeds did not show an ovulation.

#### *Certain aspects of reproduction in cross bred bulls*

The mean value of ejaculate volume, initial motility, sperm concentration, live sperm count, sperm head abnormalities and proximal protoplasmic droplets were determined. The overall rejection rate was 39.80 per cent. Most of the rejection was done before freezing. The rejection rate of ejaculate differed significantly. The rate of rejection was found to decrease with advancing age. The overall fertility rate was found to be 56.06%. There was significant difference in the fertility rate between months/season of insemination and between age of bulls. between bulls also, there was significant variation in the fertility rate.

### **ANIMAL DISEASES**

#### *Studies on the necrosis of the extreimities in cattle and buffaloes*

The incidence of the disease was more during January to May. Buffaloes were more frequently affected than white cattle. The disease was experimentally produced in buffaloes by feeding fungus-infected

straw. The condition was successfully treated with sodium thiosulphate, arsenicals and fatty acid supplements. Proper storage of paddy straw and avoiding feeding of fungus infected straw was found to prevent the condition.

#### *Experimental therapeutics of Hydrocyanic acid poisoning in goats*

Tapioca leaves were found to contain 40–50 mg of HCN per 100g leaf. The rubber tree leaves were also found to contain toxic levels of hydrocyanic acid.

#### *Incidence of Leukaemia and Leukaemoid reactions of cattle in Kerala*

The haemogram of 550 animals was studied. There was no indication of prevalence of Leukaemia or Leukaemoid reaction. Relative lymphocytosis was encountered in 114 animals. These animals had enlarged lymph nodes on clinical examination.

#### *Studies on wobbles in goats in Kerala*

Goats showing convulsive seizures and nystagmus clinically were subjected to detailed investigation. The condition was identified to be Thiamine responsive polioencephalomalacia. Treatment of animals with preparations containing Thiamine was found to cure the condition.

#### *Studies on non specific anorexia in cattle*

Anorexia syndrome in cattle was successfully treated adopting treatment schedule drawn out after preliminary trials. Administration of Dextrose, B-complex Vitamins, sodium thiosulphate 20% i/v; Liv. 52; Livol and Beekom L. supported by administration of Antibiotics were found beneficial.

#### *Efficacy of coconut water as an oral fluid and electrolyte therapy for dehydration in diarrhoeic calves*

In calves with diarrhoea, coconut water was employed to counteract dehydration. The mineral composition of coconut water was assayed and it was found to be a very useful electrolyte solution for administration in rehydrating dehydrated diarrhoeic calves.

#### *The incidence and nature of diseases of young stock in Kerala*

The mortality in calves at Nemmara was investigated and found to be due to ingestion of some weed containing a nephrotoxin. The weed is to be identified.

#### *Pathology of endocrine glands in cattle, goats and pigs*

The pathology of endocrine glands in tumour bearing animals were studied. Adaptive responses characterised by progressive transformation of cortical tissue and accessory cortical nodule formation and capsular sclerosis were seen in the adrenal glands.



### *Investigation of caseous Lymphadenitis in goats*

No significant change was noticed in cell-mediated immunity (CMI) with BCG and Tuberculin. Histopathological studies on affected lymph nodes with special staining technique (Van Gieson's, Reticulum) revealed more fibrous tissue reaction in healed lesions.

### *Investigation on posterior paryalysis in goats*

The cerebrospinal fluid of 3 suspected cases was analysed. There was slight lymphocytosis. The faecal samples were negative for parasites. Histopathological sections showed evidence of degeneration of brain.

### *Studies on the incidence, pathology and preventive measures of common diseases in goats*

Endemic pneumonia, tumours of paranasal sinuses and gastroenteritis were encountered. Histopathological studies on 415 specimens were done. A formalinised vaccine was prepared for prophylaxis against pneumonia from lung tissue of the affected animals. Injection of "Penidure" in the initial stages was curative. Paranasal sinus tumours examined were either squamous cell carcinoma or adenocarcinoma. *E. coli* organism was found responsible for causes of gastroenteritis.

### *Studies on the correlation of postnatal development of stomach compartment and the incidence of gastrointestinal diseases in goats*

Gastroenteritis was observed more in kids below one month, where in the rumen was not well-developed. More investigations are in progress.

### *Haematological studies on Malabari, exotic, and crossbred goats under different physiological and pathological conditions*

ESR, Hb, PCV, Total WBC, DC, RBC values of 83 crossbred normal goats and 16 cross bred goats (Alpine x Malabari) affected with pneumonia were compared. Those animals affected with pneumonia showed reduction in total RBC count and Hb value. In early stages of the disease there was slight leucocytosis and Lymphocytosis.

### *Investigations in Kid mortality*

There was decrease in the percentage of mortality among kids during the year. The incidence of Pneumonia and coccidiosis was very low. Histopathological studies on 123 tissues of 28 kids were made; twenty three were diagnosed as catarrhal gastro enteritis, 5 as suppurative broncho-pneumonia.

### *Clinico-pathological studies on goat pox*

No case was observed from the goat project. The hemogram of three cases brought to the University Hospital, Kakkalai was made. There was an increase in the total leukocytes and Neutrophils. The

hisopathological examination of the udder and mouth lesions from 23 previous cases were made. There were chronic suppurative cheilitis, gingivitis and dermatitis. In 3 cases there were chronic mastitis.

#### *The lymphoid system and the immune response in the goat*

The lymphocyte count and the CMI response, were studied on 4 transplanted kids (Autograft, Heterograft, Lymphnode (prescapular) biopsies were made for histopathological studies. By employing Jerne-plaque Technique attempts were made to demonstrate antibody producing cells in lymphoid organ. Using sheep RBC, this technique did not yield results in goats.

#### *The cellular response in inflammatory reaction in the duck*

ANAE technique was perfected in ducks and T cell population was enumerated. It was found that 15-18% of lymphocytes in the peripheral blood smear were positive. The pattern of distribution of ANAE in the peripheral blood leucocytes was demonstrated. Criteria for differentiation of leucocytes were described. The toxic effect of Furadan was studied. The sequence of development of lesion when Freuds's complete adjuvant was given at specific intervals subcutaneously was studied. Effect of cyclophosphamide on the immune system of duck was also studied. Histamine acid phosphatase was given s/c in the wing web and the infalammatory reaction was studied at various intervals. Delayed hypersensitivity reaction using Dinitrochloro benzene was also studied in ducks.

#### *Aflatoxicosis in goats*

Goats under experimental aflatoxicosis revealed low haemoglobin level, reduction in lymphocyte count and neutrophilia. Hepatic degeneration and focal hepatic necrosis were also present. 9 females and 6 males were sacrificed 13 months after commencing the alfatoxin administration. The control female also was sacrificed for comparison of tissue changes. Moderate degree of fatty changes and focal necrosis of the periportal hepatic cells were the lesions in the experimental animals. None of the dose under toxin administration conceived during the period. Mature ovarian follicles were absent. Kidney tubular epithelial degeneration was a prominent lesion. Degeneration, necrosis and desquamation of seminiferous epithelium were the constant lesions in bucks. Micro calculi in the renal tubules and focal areas of calcification in the testicular tissue were observed. The main effect of chronic aflatoxin poisoning in goats appears to be on the hepatic, renal and reproductive organs.

#### *Ocharatoxicosis in goats*

Nineteen young goats were given varying doses of ocharatoxin, the routes of administration were oral. Intraperitoneal and intravenous. Important finding included hepatocellular damage and renal tubular

degeneration and necrosis which are more predominant in the lining epithelium of the proximal convoluted tubules. Clinicopathological studies revealed elevated serum enzyme levels of Alkaline Phosphatase and SGOT, higher BUN and total serum proteins. Serum ICTERUS index was not raised. Slight elevation of creatinine levels also was observed. Reduction in lymphocyte count in the general circulation was an important finding towards the terminal stages.

#### *Micotoxicosis in domestic animals*

Feed samples sent from various animal stations were analysed for the presence of mycotoxins, aflatoxin and ochratoxin. The 120 items of feeds examined included yellow maize, ground nut cake, wheat bran, fishmeal, wheat, sesame and mixed feed.<sup>4</sup> About 50% of the samples were positive for an aflatoxin concentration of 0.75 – 25 ppm. Yellow maize and ground nut were mostly affected. Tissues from birds suspected to have died of aflatoxin also were analysed. Kidneys and livers gave positive fluorescence for aflatoxin bolites. The pathological effect of ochratoxin in goats was taken up as a separate study.

#### *Embryo mortality in hatcheries*

Of the fifty five hundred fertile eggs which failed to hatch on the 21st day of incubation, 50% were sticky embryos, 25% had oedema of head and neck and 10% had umbilical infections. Uneven beak, improper orientation of the embryo within the shell, double embryo etc. were the abnormalities in the remaining embryos. Histopathological and cultural examination of the dead embryos did not reveal any salient etiological features.

#### *Pathobiology of the neoplasms involving the paranasal sinuses in bovines*

The cell-mediated immune response in tumour bearing animals was evaluated using BCG as the test antigen. It showed that there had been no immune suppression in the tumour bearing animals. The cytomorphological changes observed in the regional lymphnodes in animals bearing tumour in paranasal sinuses were classified as: Lymphocyte predominant; Germinal centre predominant; Unstimulated; Lymphocyte depleted; and sinus histiocytosis. The immune response of the tumour bearing animals was also evaluated by using tumour extract as an antigen. The histological reaction was suggestive of a very poor sensitivity reaction.

#### *An assessment of the macrophage lymphoid system in animals bearing tumours of the ethmoturbinate region*

The macrophage lymphoid system of the tumour bearing host was evaluated employing different immunological markers and the scope for immunotherapy was established.

### *Cytological studies on exfoliated cells of tumours of the ethmoturbinate region in domestic animals*

Exfoliative cytological studies were undertaken and criteria for early diagnosis of the cancer were established.

### *Incidence and pathology of pneumonia in goats*

The incidence of pneumonia in goats during the last five years was assessed and the pathological features were delineated. Viral agent was found to be the basic cause in epidemic caprine broncho pneumonia.

### *Pulmonary pathology in industrial areas of Alwaye*

Pathological studies revealed lesions of bronchiopulmonary tree attributable to polluted industrial environment. Endo and peribronchitis, metaplasia of bronchial epithelium and interstitial fibrosis were commonly seen.

### *Investigation on microbial aetiology of infectious abortion in livestock in Kerala*

Two hundred and thirty serum samples screened were found to be positive for Brucellosis and Leptospirosis. In bovines, nine serum samples in dilutions up to 1 in 10,240 had positive reaction. The survey did not indicate any evidence of vibriosis.

### *Comparison of serological tests for the detection of *Leptospira* antibodies in immunised animals*

Various serological tests were employed for diagnosis of leptospirosis. The results obtained by microscopic agglutination and passive haemagglutination were closely comparable. The stability and potency of the serum remained satisfactory even after storage of the serum for 6 months.

### *Bacterial species associated with Pneumonia in goats*

*Klebsiella pneumoniae*, *Pasteurella maltocida* and *Corynebacterium pyogenes* were isolated from pneumonic cases in goats. These isolates caused disease in laboratory animals under stress conditions. The natural disease was therefore attributed to the operation of stress factor. Drug sensitivity studies were carried out and Chloramphenicol and Ampicillin were found to be the drugs of choice.

### *Bacterial species associated with enteritis in goats*

The aetiological factors associated with enteritis in goats was investigated. Enterotoxin producing *E. coli* was isolated from 15 cases. Besides this, three strains of *Salmonella* were also encountered. The drug sensitivity studies revealed that Gentamycin, Nitrofurantoin and Chloramphenicol were effective for chemotherapy.

### *Enterobacterial infections in pigs in Kerala*

*E. coli.*, *Salmonella* sp. *Shigella* sp. and *Enterobacterium* sp. were found associated with enteric infection in pigs. The isolates were found resistant to Penicillin, Streptomycin, Tetracycline and Erythrocin but they were found very sensitive to Gentamycin and Chloramphenicol.

### *Porcine enterovirus in Kerala State*

Forty one clinical samples were screened. Nineteen samples revealed viral agents. The isolates were all RNA viruses. Only porcine *in vitro* systems were found to be suitable for propagation of virus.

### *Reproductive failures in bovines due to IBR/IBV infections*

Nasal swabs from animals ailing from non-specific anorexia, foetuses, uterine and vaginal discharge were screened for the presence of virus using kidney from goat foetus. Out of the 73 samples screened five of them produced cytopathic changes. Serum samples from 297 clinically normal and those ailing from non-specific anorexia were screened for IBR infections and 61.6% of the animals had titres 1 in 8 or above.

### *Incidence, pathogenesis and control of Corynebacterium group of bacterial infection in livestock in Kerala*

The common organisms associated with corynebacteria infections were *C. pyogenes*, *C. pseudotuberculosis* and *C. renale*. These isolates did not produce the disease on experimental infections. All the isolates were found to be susceptible to penicillin. The naturally infected animals did not show any immunological deficiency.

### *The role of free flying birds in the epizootology of New Castle disease*

Free flying birds like crows, pigeons, mynas and karans were screened for detecting New Castle disease virus. The crows (12.4%) were found to excrete the virus through the cloaca or respiratory route. One of the isolates from crows was highly pathogenic to chicken. Serological survey revealed ND antibodies in 38% of the crows.

Pigeons also were found to excrete the velogenic strain of the virus without any clinical manifestation. A nonpathogenic strain of the NDV virus was isolated from myna.

### *Susceptibility of ducks to New-Castle disease virus and their role in the transmission of the disease to chicken*

Cloacal and throat swabs (151) collected from clinically normal and diseased ducks were screened for virus excretion. In 11 instances ND virus was isolated. Serological survey revealed that 15.04% carried ND antibodies. Experimental infection of duckling with NDV showed that adult ducks are resistant while those below two weeks were susceptible and died of the disease.

### *The role of parrots in the epizootology of New Castle disease*

Seventeen of the 103 blood samples taken from parrots of Kerala had antibodies of New Castle disease. There was no excretion of the virus. The parrots were very susceptible to experimental infection with velogenic and mesogenic strains. Lentogenic strains on infection produced antibodies but the titre of the antibody was not adequate enough to give protection.

### *Schistosoma spindalis infection with special reference to that in buffaloes*

190 buffaloes and 25 cattle were screened for *Schistosoma spindalis* infection. 34 buffaloes and 4 cattle were found to harbour the infection. These animals showed diarrhoea, emaciation and presence of mucus and blood in dung. The intermediate host was identified to be *Indoplanorbis* and *Lymnea* sp.

### *Pathogenicity and treatment of helminth parasites of ducks*

135 ducks were screened for the presence of helminth parasites of which 71 were found positive for one or more species of helminths. The trematods *Echinostoma revolutum*, *Hypoderaeum acuni*, *Conoidium* the cestodes, *Hymenolepis* sp., *Gastrotenia contorta*, *Amidostomum skrjabini*, *Epomidiostomum*, *Echinuria uncinata*, *Capillaria glob ocaudata* were encountered. Mebendazole at a dosage of 100 mg/kg body weight was found 90%—100% effective against naturally acquired strongyle infection.

### *Taeniasis of zoonotic importance*

Cassoni's test was done in 93 cattle using whole hydatid cyst fluid and standardised antigen to contain 25 microgram nitrogen per ml of fluid. The test gave positive reaction in 56 cattle with both antigens. False positive reaction was less with standardised antigen. Therefore, Cassoni's test can be used for diagnosing hydatidosis in cattle.

### *Incidence, pathogenicity and control of rastipec disease in cross-bred calves in Kerala*

Jersey cross-bred calves were found to be more susceptible to nematodiasis. The common nematodes encountered were *Neoascaris vitulorum*; *Cooperia* sp; *Haemonchus contortus*; *Bunostomum phlebotomum*; *Oesophagostomum radiatum*; *Trichuris Globulosa*; *Trichostrongylus colubriformis* and *Strongyloides papillosus*. *Strongyloides papillosus* caused consistently catarrhal enteritis. Thiophanate at 100 mg/kg body weight; Mebendazole at 15 mg/kg Levamisole at 15 mg/kg. Thiabendazole 100 mg/kg; parabendazole at 45 mg/kg. were found to be very effective against natural infection of *Strongyloides papillosus*. Fenbendazole at 5 mg/kg body weight was also highly effective against ascariasis and Strongyloidosis in calves.

### *Studies on coccidia infection of chicken in Kerala*

A survey on entrials of chicken from different sources in and around Trichur revealed that *E. tenella: necatrix* and *E. acervulina* are common species of coccidia. The nature of lesion was studied and the sporulation time of these a species were identified. Affected birds showed anemia, lymphopaenia and heterophilia.

### *Cutaneous myiasis and its control in domestic animals*

The breeding habits of myiasis producing flies were studied. *The Chrysomia bezziana* was found to lay the eggs on baits also. This observation was in contrast to the previcus observation that these flies will lay the eggs only on live animate objects.

### *Biology, pathogenicity and control of helminth parasites of carnivores in Kerala.*

The dogs (28) cats (36) jungle cat (1) and mangoose (4) were screened for the presence of helminth infection. *Ancylostoma caninum; Toxocara canis; Gnathostoma spinigerum, Echinococcus granulosus; Diphylobothrium latum* and *Dipylidium caninum* were the common species seen in dogs. In cats *A. tubaeformae; P. preputialis Joyeuxiella sp; D. caninum; H. T. taeniaeformis; Artyfiechinostomum sp. and Heterophyes heterophyes* were seen. *S. lupi; T. teaniformis* and *D. latum* were recorded in the jungle cat. The faecal samples of lion, tigers, jaugaur, leopards, cheatah and puma were examined. The common parasites encountered were *Ancylostoma sp; Toxascaris leonina; Strongyloides sp. and Echinococcus granulosus*. The intermediate stage of *D. latum* (procercooids) did not develop to plerocercoid in the paral fish.

### *Haematophagus Insects affecting livestock in Kerala*

The following insects were identified in areas around Trichur: Anopheles sp; Culex sp; Aedes sp; Culicoides sp; Tabanus sp; Hippobosca, Chrysops, Haematopota, Stomoxys, Liperosia, Linognathus and ctenocephalids. Three hundred blood samples from cattle and 200 samples from dogs were screened for microfilaria. Fifteen cattle and 31 dogs were found to harbour microfilaria.

### *Role of fishes and other edible aquatic Fauna as transmitters of parasitic diseases of animals and birds*

Crabs (28), fishes (64), Fresh water tortoise (2) Fresh water mussels (18) Apple snails (22) were examined. None was found to be positive for larval stages of parasites.

### *Scheme for developing irradiated Haemonchus contortus larval vaccine*

The cultures were set up to raise the larva and to study their viability and activity in the free living stage. The activity of the larvae was found to be inhibited in cold weather.

*Further studies on corticosteroids as supportive therapeutic measure in Snake Venom*

Cobra venom was found to cause death of dogs within four hours of envenomation. Betamethasone at the rate of 3 mg/kg was found to give maximum beneficial effect if given within two hours after envenomation. The envenomised animal was found to live up to eight hours after envenomisation. Antivenin must be given to save the animal after the administration of betamethasone.

*Galactagogue effect of some of the indigenous plant materials in cow*

The galactagogue effect of Asparagus (Sathavari) was studied in 12 cows. The drug was administered at the rate of 60g/animal/day for 15 days. The data on milk production have been collected.

*Study of anthelmintic activity of Butea frondosa in dogs*

The procedure for the isolation and purification of alkaloids by solvent extraction and column chromatography was standardised.

*Evaluation of antifungal property of pure plant extracts and Ayurvedic Tailams against Veterinary dermatophytes*

The efficacy of Nalpamarathi oil is being evaluated on clinical dermatophytosis. The work is in progress.

*Estimation of oxalate contents in the rumen of cattle*

Ten samples of rumen content were analysed and further work is in progress.

*Ameliorative effect of indigenous plant drugs in experimental liver injury*

The normal haematological data in dogs were collected and serum enzyme levels were estimated. The work is in progress.

*Economic assessment of different drugs used for euthanasia in dogs*

The efficacy of strychnine hydrochloride in euthanasia was studied. The other chemicals are being assessed. The work is being continued.

*Studies on antifertility compound for rodent control*

The extracts of Embelia ribes was found to control fertility in rats without causing toxicity.

*Mastitis and its control in cattle and goats*

The cellular content in the milk of normal healthy goats was studied and the normal cell count was established. The cellular pattern in different kinds of mastitis was assessed and criteria for diagnosing subclinical mastitis were described.

*Control of common avian diseases with special reference to breakdown of immunity*

The chicken were experimentally infected with Ascaridia worms following RD vaccination. Ascariasis was found to interfere with the development of adequate antibody against RD virus. It was therefore concluded that deworming should be practiced before vaccination.



### *Haematology in common viral disease of bovines*

Blood samples collected from three cases of Foot and Mouth disease in cattle were examined. There was no significant variation from the normal.

### *Effect of coccidiostat on antibody response to New castle disease vaccination*

The chicken were given prophylactic and therapeutic levels of cordinal before, during and after vaccination against RD. There was reduction in immune antibody response in cordinal treated groups as compared to controls. The reduction was more in birds given therapeutic levels of cordinal. The cordinal was therefore found to have immunosuppressive effect in chicken.

### *Intra-ocular pressure variations in indigenous and cross-bred cattle*

Since no marked variation could be noticed from the preliminary studies, the project was discontinued.

## MISCELLANEOUS

### *Anaesthesia in goats*

Various concentrations of Lidocaine hydrochloride were used to induce epidural anaesthesia in goats- A 2% solution at the rate of 4 mg/kg body weight was found to be satisfactory for surgical operations at the hind quarters and inguinal region. A dose rate of 8 mg/kg body weight was needed for operation in the flank region. A quick onset of anaesthesia was observed when hyaluronidase was incorporated and this also prolonged the extent of analgesia.

### *Chloral hydrate for general anaesthesia in goats*

Chloral hydrate at different dose level was administered i/v with or without premedication with Triflupromazine hydrochloride. The trials were conducted in 36 goats and the data have been collected for analysis.

### *Treatment of fracture of tibia in calves and its radiographic evaluation*

The trials were conducted in 16 crossbred bull calves. In the group in which plaster of paris cast alone was used, reduction of fracture was not satisfactory. In the group in which Kuentscher blower leaf nail was used for treating tibial fractures, six out of 10 animals had clinical cure.

### *Pattern and intensity of cropping in a village*

Intensity of cropping and cropping pattern in Madakkathara village was estimated on the basis of a survey. It was found that the intensity of cropping was 129% which was the same for Trichur district and Kerala State. 22.5% of the area was under HYV of paddy whereas it was 94.99% and 22.4% for rubber and cashew respectively.

It was found that 73% of the irrigation was from government canals. The pattern of cropping was similar in holdings in the range of 0.25 to 10 acres.

*Estimation of meteorological factors in various centres of Kerala to the north of Ernakulam*

Weekly rainfall was estimated at levels of confidence 10%, 50%, 80% and 90% for Malayattoor, Cannanore, Cherpulassery, Thalappally, Peechi, Trichur, Cochin, Moovattupuzha, Badagara, Ponnani, Mannarghat, Palghat, Mahe, Manjeri, Ottappalam, Thirurangadi, Hosdurg, Kasargode and Perinthalmanna.

*Pattern of growth in domestic fowl*

Data were collected from 130 birds for a period of 5 months. Work is being continued.

*Incomplete block designs of equal or unequal block sizes with equal or unequal replications*

Some new results on the relation between parameters of proper equi-replicate balanced designs have been established. Further work is in progress.

*Slaughter house practices and meat trade in Kerala with special reference to Trichur and suburbs*

Meat samples collected from slaughter houses were examined with reference to total aerobic count, coliform count and count of indicator bacteria. A total of 80 samples were examined. It was found that all the values obtained were higher than prescribed in developed countries. Samples from University slaughter house was better. Water having 50 ppm of chlorine was found to be acceptable for washing carcasses to reduce the bacterial load.

*Preliminary study to assess the mass loss/shrinkage in cattle and buffalo subjected to transport on hoof*

Weight of animals transported on hoof was recorded at start and finish of the transit. Distance travelled and time as well as sex of the animal and season were collected. It was found that during the transport of 145 km in 52 hours on foot there was a shrinkage of 4.3% of the live weight.

*Preliminary study to evolve a suitable formula for predicting the live weight of slaughter cattle and buffaloes*

Various body measurements such as length, girth and height were taken and the live weight measured on a weigh bridge. Data on 170 animals have been collected. The work is being continued.

*Study on the influence of cattle sheds on the bacterial quality of domestic well water*

Water samples were collected from randomly selected wells in Ollukkara area and subjected to total viable count of bacteria and indicator bacteria. A sanitary survey of these wells was conducted with the help of a proforma. Till now 73 samples were tested and the work is being continued.

### *Certain post slaughter physico-chemical changes in beef*

25 samples of meat were collected. The initial glycogen level was estimated. The pH changes of plain, salted and sweetened meat was determined till spoilage and at refrigerated temperature for two days.

The initial glycogen level and time taken for spoilage were found to be positively correlated. It was found that postmortem changes taking place in meat is influenced by physical and chemical treatments. The farm produced meat had a higher initial glycogen content and longer keeping quality.

It was concluded that keeping quality of meat can be enhanced if proper rest is given to the animals prior to slaughter.

## FISHERIES

### ONGOING PROJECTS

#### *Seed resources survey of cultivable species of prawn and fish near Cochin barmouth area (Vytila)*

From the survey, the availability of the seed of *Penaeus indicus*, *Metapenaeus dobsoni* and *M. monoceros* and the smaller mullets in fairly large quantities were recorded.

#### *Mono and poly-culture of selected species of fish and prawn with and without artificial feeds (Vytila)*

Fish production was raised to the tune of 1,130 kg/ha/6 months with supplementary feeding and to 1,353 kg/ha/7½ months without supplementary feeding.

#### *Studies on the ecology of brackishwater ponds in relation to productivity (Vytila)*

From the nursery rearing of *Mugil dussumieri* @ 50,000/ha and 1,00,000/ha, a survival rate of 86.5% and 80.0% were respectively achieved after 40 days rearing.

#### *Studies on the ecology of brackishwater ponds in relation to productivity (Vytila)*

The study is in progress.

#### *Prawn culture in pokkali fields after the harvest of paddy (Vytila)*

From prawn culture through traditional methods, production @ 1,766 kg/ha/year was obtained. From the selective stocking of *Pindicus* a gross production of 917/kg/ha/year was achieved.

#### *Observational trials on fish culture in homestead ponds (Vytila)*

Under the scheme fish culture is in progress in 6 farmers' ponds. *Rice-cum-fish culture in the punja fields of Kuttanad for standardisation of cultural practices (Moncompu)*

A field experiment was conducted at the station during the punja season 1980-81. 500 numbers of common carp fingerlings were released into the plot where Jaya was grown. The length and weight of

fingerlings were recorded before release. Growth records of fishes and pH of water were also recorded regularly. Yield of rice was satisfactory. The growth of fish was not very encouraging. Fish predators posed the major problem.

#### *Induced breeding of Indian major carps (Moncompu)*

The Indian major carps were tried for induced breeding by injecting pituitary hormones. *Labeo fimbriatus* a minor carp was tried first as the major carps were only attaining the stage of breeding. The experiment was not successful due to sudden fluctuations in pH.

#### *Pig-cum-fish culture (Kumarakom)*

Intensive farming of fish using pig dung as feed is envisaged in this project. Pig dung collected from the piggery is fed to *Etroplus*, Mrigal and other carps stocked at the rate of 125, 100 and 100 nos. respectively in a pond. In the control pond feeding was with coconut oil cake and rice bran (1:1) at 2% of the total body weight. Results of harvest showed that 178 kg/ha fish was obtained from pig dung fed pond while from the other it is only 50 kg/ha.

#### *Mass production of pearlspot fish seed (Kumarakom)*

To study the economic viability of *etroplus* seed production, adult *etroplus* collected from the station channels were stocked in separate ponds and fed artificially. 12000 fingerlings were obtained during the year.

#### *Propagation and farming of frogs (Kumarakom)*

The project aimed at propagation of commercially important varieties of frogs so as to produce large quantities of juvenile frogs to be released in the paddy fields and natural waters. Standardisation of economically feasible methods of culture (up to the adult stage for maintaining a breeding stock) was also envisaged.

Preliminary surveys were carried out to study the various available species. Regular catching studies revealed that ten to fifteen frogs (mean weight 85 gm) could be collected by an individual in an eight-hour day. Maximum commercial collection (night collection) was obtained during August–November. The daily collection ranged between 70 and 89 and the average income from Rs. 40/- to Rs. 60/-. The main species collected for export were *Rana hexadactyla* and *Rana tigrina*.

A temporary spawning pond (100 m<sup>2</sup>) was constructed (with 1/3rd area kept under water to simulate natural environment). Fifty adults each of *R. hexadactyla* and *R. tigrina* were stocked in the pond for studying their breeding behaviour. Sex (female : male) ratio in *R. hexadactyla* varied from 3 : 1 in March to 15.5:1 in July. In the case of *R. tigrina*, the ratio ranged in from 1:0 in Dec–Jan to 5:1 in August. Males were found to be smaller than females in both the cases.

The ovaries contained two batches of ova mature batch ready to be released in the season and an immature batch which will be ready for spawning during the next season. The two species were seen to spawn only once an year, during May-July period.

There was not much variation in the feeding habits of the two species. Experiments aimed at finding better feeds for rearing tadpoles revealed that dried fish meal and butchery waste were the best items. ●

## CHAPTER IV

# Extension Education

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Dr. V. S. S. Potti continued as the Director of Extension during the period under report. List of other members of staff is given in Appendix IV. Major achievements of the Extension Wing included the establishment of a colour processing laboratory with modern equipment, a photographic cell with sophisticated cameras with zoom lens and other accessories, establishment of an information museum, publication of a series of books and pamphlets, organisation of a sales counter and broadening the information communication programme. Books on coconut and paddy in Malayalam in the form of persuasive messages helpful both for farmers and extension workers were published. The activities of the Extension Wing are summarised in the following pages.

### TRAINING PROGRAMMES

#### *Training in rice production technology - Minikit trials*

One hundred and thirteen Junior Agricultural Officers attended the training conducted at different centres. The details of the training programmes are given below:

Venue	Period	No. of candidates attended
Communication Centre, Mannuthy	28th to 31 st May 1980	31
College of Agriculture, Vellayani	26th to 29 th May 1980	28
College of Agriculture, Vellayani	29th Dec. '80 to 1st Jan. '81	28
Rice Research Station, Pattambi	29th Dec. '80 to 1st Jan. '81	26

#### *Training in microbiological technique to the Junior Agricultural Officers*

Nine candidates attended the 10-day training conducted at the College of Agriculture, Vellayani. The first training course was conducted from 21st to 31st July '80 and the second, from 16th to 27th Feb. '81.

***Advanced training in plant protection to the Departmental Officers***

Sixteen candidates attended the advanced training in plant protection conducted at the College of Agriculture, Vellayani. The training for the first batch was from 13th to 31st Oct. '80 and for the second batch, from 12th to 30th Jan. '81.

***Short training course in pulses development and oil seeds conducted by the Extension Centre, Rice Research Station, Kayamkulam for District level officers and Junior Agricultural Officers***

Altogether five batches (86 trainees) attended.  
The details are given below:

Venue	Period	No. of trainees attended
District Agricultural Farm, Taliparamba.	28th to 31st Oct. '80	18
Office of the Dy. Director of Agri., Ernakulam.	8th to 9th Dec. '80	20
Extension Education Centre, Kayamkulam.	18th to 20th Dec. '80	18
Model Agronomic Research Station, Karamana.	22nd to 24th Dec. '80	20
Rice Research Station, Pattambi.	4th to 6th Dec. '80	10
Total		86

***Training in seed certification***

Five candidates were trained at the Rice Research Station, Pattambi between 14th and 29th November, 1980.

***Training in Statistics for research workers on KAU and JAO's of KLD & MM Board.***

Nine candidates were given training in design and analysis of experiments. Six Officers of KAU and three Junior Agricultural Officers of KLD & MM Board attended the above training.

***Centrally sponsored scheme for the quality control of inputs—Training programme in fertilizer analysis to Junior Agricultural Officers,***

Fourteen candidates in three batches were trained at the College of Agriculture, Vellayani as shown below.

Batch No.	Period	No. of candidates
1st	1st to 30th Sept. '80	5
2nd	10th Nov. to 9th Dec. '80	5
3rd	28th Jan. to 28th Feb. '81	4

### *Training in pests and disease surveillance*

Sixty seven candidates have participated in the training. The details are given below:

Venue	Period	No. of candidates
Rice Research Station, Moncompu	1st to 6th Dec. '80	24
-do-	15th to 20th Dec. '80	21
Rice Research Station, Pattambi.	15th to 20th Dec. '80	22
		67

### *Training programme for Rural Development Officers of State Bank of India*

One batch of 43 Rural Development officers of the State Bank of India attended a 13 day training conducted at the Communication Centre, Mannuthy.

### *Organisation of a programme of educational utilization of Indian standards in the field of Agriculture*

Sixty Officers of the Kerala Agricultural University attended the training which was conducted at the Communication Centre, Mannuthy.

### *Training of KAU teachers in the preparation and use of audio-visual aids*

Two batches of 16 Faculty members of the College of Veterinary and Animal Sciences, Mannuthy and the College of Agriculture, Vellayani attended the four-day training conducted at College of Agriculture, Vellayani.

### *Training in fungal and viral diseases and pests on pulse crops*

Two batches of 47 Junior Agricultural Officers and Agricultural Demonstrators of Trichur District attended the one day training programme conducted at the Agronomic Research Station, Chalakudy on 26th & 27th February, 1981.

### *Special training for Branch Managers of the Catholic Syrian Bank*

Experts of the University handled classes on General Agricultural Situation in the country as well as on coconut, cocoa, pepper etc. with special reference to their cost of cultivation.

### *Inservice training programme for Agricultural Demonstrators for six months*

The 4th batch of training course was conducted from 10.10.79 to 9.4. '80. A total number of 63 candidates attended.

### *Training to VEO's under the "T & V" Programme*

Out of 306 candidates enrolled, 260 trainees have passed, 39 failed and seven have discontinued the course. Duration of the programme was



six months. The details of the training programme under T & V system are given below.

Venue	No. of candidates enrolled	No. of trainees discontinued/ incomplete.	No. of trainees passed	No. of trainees failed
College of Horticulture, Vellanikkara.	123	4 (Maternity leave)	110	9
College of Agriculture, Vellayani.	111	3 (trainees relieved to accept job elsewhere & one discontinued due to illness.	80	28
Institute of Agrl. Technology, Tavanur.	72	—	70	2
	306	7	260	39

*Training programme in Agriculture to Fieldmen from Lakshadweep*

One batch of five candidates deputed from the Union Territory of Lakshadweep underwent the training for a period of one month from 19-6-'80 to 18-7-'80. The training was conducted at the College of Horticulture, Vellanikkara, the Banana Research Station, Kannara and the Communication Centre, Mannuthy.

*Training in house-hold arts*

Training was imparted to 43 rural women selected from the adopted villages in two batches.

*Training in fruit and vegetable preservation for farm women*

Training was imparted to 243 rural women in eight batches of 30 each at the College of Agriculture, Vellayani. The participants were selected mainly from the adopted villages and from the NES Block adopted for applied Nutrition Programme work, the Trivandrum Rural Block.

*Training programme to NCC Cadets in Agriculture and allied subjects*

A 12 day camp was arranged for the NCC Cadets at the College of Horticulture, Vellanikkara. Four hundred NCC cadets attended the training camp.

*Short term training in diagnostic techniques of bacterial and viral diseases*

Three Veterinary Surgeons of the Animal Husbandry Department underwent the above training from 8-9-'80 to 30-11-1980 at the College of Veterinary and Animal Sciences, Mannuthy.

### *Training in Veterinary Public Health*

The training programme in Veterinary Public Health was conducted from 1-10-'80 to 31-10-'80. Four Veterinary surgeons of the Department of Animal Husbandry attended the training conducted at the the College of Veterinary and Animal Sciences, Mannuthy.

### *Training in diagnostic techniques and treatments of infertility/sterility problems*

The training was conducted from 25-11-'80 to 24-12-'80 at the College of Veterinary and Animal Sciences, Mannuthy. Five officers deputed from the Department of Animal Husbandry attended the training.

### *Training in assessment of nutritional status of animal serum analysis*

Three batches of six candidates attended the one week training conducted at the College of Veterinary and Animal Sciences, Mannuthy.

### *Refresher course for Assistant Directors of Dairy Development Department*

Two batches of Assistant Directors deputed from the Department of Dairy Development were trained at the College of Veterinary and Animal Sciences, Mannuthy. A total number of 12 candidates attended the course.

### *Inservice training for Dairy Farm Instructors*

Total number of 45 Dairy Farm Instructors were trained at the College of Veterinary & Animal Sciences, Mannuthy. Duration of the training programme was 24 working days.

### *Livestock Assistants Training course at I. A. T., Tavanur,*

The third batch of training which commenced on 16.7.79 was completed on 15.6.1980. A total of 75 candidates have successfully completed the course.

### *Training in laboratory techniques for Livestock Assistants*

The training started on 25.3.1981 at the College of Veterinary and Animal Sciences with seven candidates deputed from the Kerala Agricultural University. Duration of the training programme was six months.

### *Short term training in poultry*

Two batches of 18 livestock assistants deputed from the State Department of Animal Husbandry were trained at the College of Veteri-

nary and Animal Sciences. The first batch of training was conducted from 1.1.'81 to 31.1.'81 and the second batch from 1.2.'81 to 28.2.'81.

*Training in Dairying to Defence Personnel*

Two batches of 22 candidates attended the one month training course. The 1st batch of training was conducted during July 1980 and the second batch during February 1981.

*Training in poultry management for Defence Personnel*

One batch of 12 candidates attended the one month training conducted at the College of Veterinary and Animal Sciences during December, 1980.

*Training in Dairy Husbandry and Management to candidates sponsored by AFPRO*

The training programme conducted at the College of Veterinary and Animal Sciences, Mannuthy commenced on 2.6.1980 and ended on 28.6.1980. One batch of 14 candidates attended the training.

*Training to Para Veterinary Staff of the Union Territory of Lakshadweep*

A training course for the para Veterinary staff of the Union Territory of Lakshadweep was conducted at the College of Vety. & Animal Sciences, Mannuthy. Seven trainees attended. The topics covered were practical poultry management (one month), clinics (one month) and farm management (three months).

*Training in clean milk production and quality control of milk and milk products*

A total of 10 candidates deputed by the Kerala Livestock Development and Milk Marketing Board attended the two week training organised during September 1980 at the College of Vety. & Animal Sciences, Mannuthy.

**FARM ADVISORY SERVICE & SEMINARS**

A Farm Advisory Service was started during May 1979 as part of the Directorate of Extension Education to give an opportunity to the farmers to discuss the various technical problems confronting them for raising the agricultural production in their area, to have a recorded information from the farmers regarding the intensity and magnitude of the problems and to expose the specialists to the various needs of the farmers in the State.

For achieving the above objectives, 33 District Level Agricultural Seminars were conducted as below:

Date	Place	No. of farmers participated
10.4.1980	Mulayam - Trichur	102
7.6.1980	Elenji-Ernakulam	172
21.6.1980	Edathirinji-Trichur	151
28.8.1980	Cheruthuruthy-Trichur	138
15.1.1980	Pattikkad-Trichur	142
19.9.1980	Kasargode-Cannanore	128
28.9.1980	Ochira-Quilon	350
15.11.1980	Ayroor-Malappuram	60
21.11.1980	Manakkadu-Cannanore	126
22.11.1980	Maraicheri-Malappuram	130
24.11.1980	Chittanikkal-Cannanore	106
6.12.1980	Cheruvathoor-Cannanore	145
12.12.1980	Pozhuthana-Calicut	111
13.12.1980	Kelakam-Cannanore	125
12.12.1980	Kazhirode-Cannanore	133
19.12.1980	Quilon-Quilon	750
19.12.1980	Kadungapuram-Malappuram	108
20.12.1980	Edayoor-Malappuram	210
27.12.1980	Tharoor-Palghat	207
2.1.1981	Puthuppadi-Calicut	98
3.1.1981	Puthuppadi-Calicut	108
7.1.1981	Champakulam-Alleppy	250
17.1.1981	Trichur-Trichur	120
19.2.1981	Uzhumalakkal-Trivandrum	75
21.2.1981	Ettumanoor-Kottayam	145
24.2.1981	Parippu-Kottayam	140
28.2.1981	Kolaicheri-Ernakulam	142
7.3.1981	Vennamada-Palghat	141
12.3.1981	Allukkal-Trivandrum	71
19.3.1981	Manakkadu-Idukki	56
21.3.1981	Vaniyampara-Trichur	60
23.3.1981	Maijalloor-Ernakulam	50
29.3.1981	Chettichal-Trichur	135

The participants of the seminars were supplied with tear pads. The written and oral questions on Agriculture & Animal Husbandry problems were discussed by the experts and answers were given to them then and there. The problems faced by the cultivators which require further investigations were given to the research wing of the University. The questions and answers discussed were cyclostyled

and made in the form of books and supplied to the participants of the concerned seminars.

#### PACKAGE OF PRACTICES WORKSHOP, EXHIBITIONS ETC.

Workshop on Package of Practices for crops was conducted on 11th and 12th of March, 1981.

The Kerala Agricultural University took active part in the Trichūr Pooram Exhibition. Information on the University activities such as teaching, research and extension were displayed. Demonstration plots of Home Nutrition Garden and other crop plants provided information and interest to people from all walks of life. There were 100 panels giving information on the Package of Practices to be followed for different crops, livestock and poultry and innovation from research projects too. Kerala Agricultural University exhibits won the first prize.

Twenty three mini exhibitions were organised in connection with the Lab to Land programme and district level seminars, in collaboration with local organisations as well as Village Adoption Programme. Slide shows and film shows were also arranged along with the mini exhibitions.

#### UNIVERSITY PRESS

Text books on various scientific topics, periodicals, technical bulletins, college magazines, research reports, lessons for correspondence courses, registers and forms required to meet the entire demand of the University were printed at the Kerala Agricultural University press. During the period under report, about 200 different items of work were completed.

##### *Regular publications were:*

- Kalpadhenu
- Newsletter
- Agres News Supplement
- Kerala Journal of Veterinary Science
- Agricultural Research Journal of Kerala
- Anivet Abstracts
- Hort Abstracts
- Budget Estimates
- Annual Report 1979-80
- Annual audit report
- Budget speech
- Research Reports 1978-79

##### *Other publications brought out during the period were*

- Rice Research Station, Kayamkulam (booklet)
- Kerala Agricultural University (booklet)
- Kerala State Co-operative Endowment lectures
- Vth Five Year Plan proposals

Veterinary College Silver Jubilee Souvenir  
Codified List of Research Projects, 1980.

കോഴിവസന്ത

വീട്ടുവളപ്പിലെ പുത്തോട്ടം

വിള ഉദ്പാദന ശാസ്ത്രം (ടി & വി നോട്ട്)

സസ്യസംരക്ഷണം ,,

കാർഷിക വിളകൾ ,,

വിജ്ഞാനവ്യാപനം ,,

കാർഷിക എൻജിനീയറിംഗ് ,,

An HMT Printing Machine has been ordered and the same is expected soon. The efficiency of the press will be further increased after shifting to its new location (Small Animal Breeding Station Building) and commissioning of the new HMT machine.

RADIO PROGRAMMES, CORRESPONDENCE COURSE ETC

Extension division provided information support to the farmers as "Agricultural Science News" "Instructions to farmers and extension workers" "Talks and Interviews" "Farm School on AIR" etc., through the All India Radio.

One hundred and nine items of science news were broadcast from Trichur and Calicut Stations of All India Radio. Of these, 84 items were highlights of the findings from the University research programmes undertaken by Agriculture and Veterinary Faculties and the rest 25 from other sources.

Timely tips were broadcast from Calicut and Trichur Stations on every Friday morning for the benefit of farmers and Extension Workers under the programme "Instructions to farmers and extension workers". A total of 73 items which were timely and appropriate to the growth cycles of the crop were broadcast.

Under the "Talks and Interviews" programme, the Kerala Agricultural University actively participated in the All India Radio Advisory Committee meetings and Subject Matter Committee meeting of both Trichur and Calicut Stations. Topics for every quarter along with the names of resource persons were suggested and 72 items were broadcast during the year. Care was taken to see that the talks and interviews were relevant and appropriate to the field situations.

Series on "profitable poultry farming" and "fertilizer application" were broadcast under the "Farm School on AIR" programme. Prizes for the selected best listeners were distributed at the Farm and Home annual celebrations held at Kothamangalam.

Correspondence courses on "profitable poultry farming" and "coconut cultivation" were started simultaneously with 16 and 18 lessons, respectively. The lessons of both the courses were mailed every fortnight till 31-3-1981. The answers received from the participants

were assessed and sent back. A total of 266 and 224 farmers had registered for the courses on "poultry farming" and "coconut cultivation", respectively

### PUBLICATION UNIT

During the year the Publication Unit brought out a number of publications, both free and priced-categorized under books, booklets, technical bulletins (Agricultural Science series), pamphlets, leaflets, etc.

The details of publications brought out are furnished below:

- Rice Research Station, Kayamkulam (booklet)
- Kerala Agricultural University (booklet)
- Kerala State Co-operative Bank Diamond Jubilee Endowment lectures.

ലാഭകരമായ കോഴിവളർത്തൽ

കായിക പ്രവർദ്ധനം

പോഷകത്തോട്ടം

കശുമാവ്

വീട്ടുവളപ്പിലെ പൂന്തോട്ടം

നെല്ല്

തെങ്ങ്

ശുദ്ധജല മത്സ്യക്ഷയ്ക്കി

ലവണജല മത്സ്യക്ഷയ്ക്കി

ഗവേഷണോപഹാരം (നെല്ല് ഗവേഷണ കേന്ദ്രം, വൈറില)

തലയോട്ടുകളിലെ ക്യാൻസർ

ക്ഷയ്കിവിജ്ഞാന കേന്ദ്രം

കോഴിവസന്ത

വിള ഉപപാനേ ശാസ്ത്രം (ടി & വി നോട്ട്)

സസ്യസംരക്ഷണം

കാർഷിക രസതന്ത്രം

കാർഷിക വിളകൾ

Apart from this, the unit is attending to the work of publishing 'Agres News' a quarterly in English which contains the details of latest technological development in the field of Agriculture, Animal Husbandry and Fisheries. This publication is meant for the technical staff of development departments to keep them abreast with the latest technological development.

### VILLAGE ADOPTION PROGRAMME

The main role of the University is to provide leadership for the overall development of the adopted villages. The programme also aims to build up close relationship between the University and the farming community, to transfer the recently developed technologies to the farmers to find solution for their problems. The Kerala Agricultural University has 12 adopted villages. An Intensive drive has been made during the year in distribution of seeds, seedlings, fertilizers, chicks,

goats etc. Seminars, training camps, field days, mini exhibitions and home visits were conducted for increasing production in Agriculture and Animal Husbandry by the adoption of improved production technologies.

Planting materials; fertilizers etc., were distributed to the farmers at each adopted village on 'no loss no profit' basis as a part of their home-stead development.

Other activities done in the adopted villages during the period under report were:

#### *Demonstrations*

Necessary operations in the pineapple demonstration plots like fertilizer application was attended to under the guidance of the experts of the University.

Eradication of bunchy top disease of banana was taken up in the adopted villages.

Five kitchen gardens were started and the required seed materials were distributed to the farmers.

Demonstration with gingelly have been laid out in rice fallows with the object of convincing the farmers that the yield of gingelly can be increased considerably by the application of fertilizers along with irrigation.

#### *Group discussion and field visits*

The project leaders and joint project leaders regularly visited the villages. The experts conducted field visits and participated in group discussions to solve the agricultural problems.

#### *Training camps*

Training for farmers in the "use of plant protection equipment", "propagation practices of fruit plants", "poultry rearing" and "cocoa pruning and processing" were conducted at the Institute of Agricultural Technology, Tavanur. A sterility camp was also organised in collaboration with the veterinary Hospital of the Department of Animal Husbandry. Twelve cows were examined and medicines distributed free of cost.

Four-one day training camps were conducted for the benefit of farmers in the adopted villages. The subjects covered were pulse crop cultivation, methods of soil sample collection, poultry keeping in backyard system and application of fertilizer and maintenance of soil fertility.

#### *Seminars*

On an average three to four agricultural seminars were conducted in each village. Experts from the University handled classes on various topics such as improved cultivation practices, soil fertility fertilizer



application, animal husbandry, plant protection measures etc. Mini exhibitions were also conducted at different villages by the Communication centre in connection with field days.

#### *Participation of co-operative societies in the village Adoption Programme*

The service co-operative societies showed keen interest in all the Agricultural and Animal Husbandry programmes. Distribution of inputs, selection of plots etc., were done through the co-operative societies. The supply of fertilizers, poultry feed etc., was also attended to by the societies.

#### *Study tour*

About 60 farmers of the Kozhukully village who have shown keen interest in the programme were taken to the various departments of the college of Horticulture and the College of Veterinary & Animal Sciences and to the adjoining Farms. The Specialists explained to them the various activities in the Departments and the Farms.

#### *Vaccinations and other programmes*

Vaccinations to cattle and poultry have been arranged through the Veterinary Dispensary at Moorkanikkara. Film shows on cattle and poultry were also organised in the adopted villages.

#### **T & V TRAINING PROGRAMME, MONTHLY WOKKSHOP ETC**

##### *Training Programme*

T & V training programme was conducted at three centres in the Kerala Agricultural University (College of Horticulture, Vellanikkara, College of Agriculture, Vellayani and Institute of Agricultural Technology, Tavanur).

At the College of Horticulture, the training commenced on 16th July 1980 and 123 Agricultural Demonstrators deputed from the Department of Agriculture were trained.

During the first four months, theory classes on different subjects were taken. The rest of the period was utilised for imparting skill on the production technology of various crops at different centres under the Kerala Agricultural University. The training centres selected for field training were: Instructional Farm, Mannuthy, Cashew Research Station, Madakkathara, Banana Research Station, Kannara, Pineapple Research Station, Vellanikkara, Pepper Research Scheme, Vellanikkara, KADP Scheme, Vellanikkara, Division of Agronomy and Division of Entomology. Work experience programme for rice cultivation and vegetable production were conducted. An area of 40m<sup>2</sup> wet land was allotted to each trainee for rice cultivation. Under the vegetable production programme, cucumber, pumpkin, snakegourd, bittergourd, ashgourd, amaranthus, bhindi, brinjal etc. were raised by the trainees. Pre-training evaluation of the trainees was conducted. Two quizzes, mid-term and final evaluations

were conducted during the six month training period. At College of Agriculture, Vellayani, the training commenced on 16th July 1980. One hundred and eleven Agricultural Demonstrators deputed from the Department of Agriculture (2 were relieved on their request and one discontinued due to illness) were trained. During the first four months, theory classes on different subjects were taken. During the remaining period, the trainees were given field oriented training in the following centres: District Agricultural Farm, Peringammala, Trivandrum, Seed Farm, Ulloor, Coconut Nursery, Kazhakkottom, Agronomic Research Station, Karamana, Trivandrum, Agricultural College Farm, Vellayani, and RTT Centre, Vellayani. An area of 1.5 cents per trainee was allotted for vegetable cultivation. They cultivated 15 varieties of different vegetables. An area of 0.5 cent per trainee was given for rice cultivation also.

Pre-training evaluation of the trainees was done. Two quizzes, one mid-term and one final evaluation were conducted during the period of six months. At the Institute of Agricultural Technology, Tavanur, also the training commenced on 16th July 1980. Out of the 75 trainees deputed, only 72 joined for the training. Here also the six month training programmes was divided into two sessions. In the first four-month session, the theory classes on different subjects were taken. In the second session, field oriented training was given. Besides, they were taken for a study tour to the Pineapple Research Station, Vellanikkara, and the Banana Research Station, Kannara.

For rice cultivation no separate area was allotted due to lack of staff and facilities. They were given practical training in the existing crop. For vegetable cultivation, the crops raised were bhindi, brinjal, amaranthus and chillies.

A pre-training evaluation and a series of four tests were conducted as in the other centres.

#### *Monthly Workshops*

The major objectives of the monthly workshops are to provide the technical know-how to the Subject Matter Specialists with reference to the calendar of operations for various crops, to provide guidance to the Subject Matter Specialists in the preparation of lessons for the fortnightly training session for village level workers (by giving model lesson material separately covering the two fortnightly periods) and to provide channel for exchange of information and feed back of field problems to the research Scientists. The monthly workshops were conducted at the College of Agriculture for Trivandrum and Quilon Districts and at the Rice Research Station, Moncompu for Alleppey and Kottayam Districts.

An orientation programme on the organisation and conduct of monthly workshops was held at Vellanikkara. A team of Scientists of the University has been designated as the resource personnel for leading the

discussions at the workshop at the respective centres. Government sanction has been received to implement the workshop only for three districts (Trivandrum, Quilon and Alleppey).

#### KRISHI VIGYAN MELA AND SEMINARS

Four Krishi Vigyan Melas and Seminars were conducted at Neeleswar, Panniyur, Vyttila and Moncompu. In connection with the Silver Jubilee Celebrations of College of Agriculture, Vellayani, and the College of Veterinary & Animal Sciences, Kissan Melas along with exhibitions were also organised.

#### KRISHI VIGYAN KENDRA

The objective of the Krishi Vigyan Kendra, Pattambi is the development of skill in farmer trainees to the point that the farmer trainees can repeat what they have learnt on their own farms with confidence. Twenty four training courses were conducted on eight different aspects. Three hundred and eighty nine farmers were trained during the year. Training courses on "pest surveillance" for Agricultural Demonstrators "rice production" for Officers of Agriculture Department and field training for final B. Sc. (Ag.) students of the College of Agriculture, Vellayani were the other activities.

#### LAB TO LAND PROGRAMME

Seven hundred and fifty families as indicated below were selected for assistance under the Lab to Land Programme, These 750 families were classified as below:

<i>Centre</i>	<i>No. of families</i>
Oilukkara	40
Madakkathara	40
Panencherry	40
Kozhukully	40
Odakkaly	45
Trithala	40
Keezhayoor	40
Muttacad	35
Kalliyur	35
Moncompu	45
Ambalavayal	30
Tavanur	45
Panniyur	18
b Anakkayam	18
Nileshwar	18
to to Pilicode	18
ert to Chalakudy	18
ert to Vyttila-R	18

Vyttils-F	20
Kumarakom	18
Chittoor	18
Thriuvalla	18
Alwaye	10
Kudikidappu	10
KESS	10
Fishery, Mannuthy	10
Hqrs. Vellanikkara	13
Karamana	10
Balaramapuram	10
Kayamkulam	10
Pampadumpara	10
	<hr/>
	750

Holding size (ha)	SC	ST	Backward	Others	Total
Landless	96	8	38	65	207
0.5 to 1.0	—	10	—	345	355
1.0 to 1.5	—	—	—	97	97
1.5 to 2.0	—	—	—	21	21
2.0 to 3.0	—	—	—	26	26
Above 3.0	—	—	—	44	44
<b>Total</b>	<b>96</b>	<b>18</b>	<b>38</b>	<b>598</b>	<b>750</b>

During 1979-80, the extra inputs per adopted family was limited to Rs. 200/- while in 1980-81 extra inputs upto Rs. 465/-per family were provided. An inter disciplinary team of 53 University Scientists was directly involved in the transfer of technology. A lab to land manual was prepared for the guidance of the implementing officers. A book let on the participants of the KAU Lab to Land programme was published in which the extra inputs required for the development of the farm families (based on bench mark survey and malady-remedy analysis) were recorded. The farmers in general were adopted from the sub-marginal landless labourers and tribal farmers. A mixed farming approach incorporating Animal Husbandry, poultry, goat, fish etc. were included for the development of the individual homesteads. Utilisation of under-employed period of the farm family members through self employment is the theme of the programme.

Rearing of goats for milk and meat was very encouraging. The landless farmer could get milk for his family. The Alwaye Settlement alone had goats for one hundred families. The maximum yield recorded from one goat was 1.5 lit. during one milking.

The needy farmers were supplied with ten improved strains of fowls for egg and meat production. The number of birds were limited as it was felt that for Kerala conditions production by mass would be better than mass production. Three thousand five hundred birds were supplied to the adopted families. Each family could get, on an average, three eggs per day within the limited resources. The subsidiary income of the family could be enhanced and also the nutritive food could be consumed by the members of the family. Due to the heavy floods in the early 1980 in the low lying areas of the state, the rate of mortality of birds happened to be very high.

Duck rearing, and fish farming could be introduced in many centres. This has been found to be the most viable technology in enriching the income of the adopted families. A firm has been already established for the supply of fingerlings for the inland fish farming industry. Field days, agricultural seminars kisan melas and agricultural exhibitions were organised at all the 31 Transfer of Technology Centres.

Horticultural plants were supplied for planned development of the homesteads. Cocoa seedlings planted were on flowering stage and banana bunches were harvested during this period.

Supplementary feed for cattle, poultry and fish were provided. Fertilizers were also supplied wherever necessary for increasing agricultural output.

*Details of inputs supplied*

Fertilizers	47846 kg
Plant protection chemicals	2548 ..
Copper sulphate	25 ..
Quick lime	150 ..
Sprayer (Knap sack)	1 Nos
Nutmeg seedlings	100 ..
Clove seedlings	556 ..
Cocoa seedlings	538 ..
Coconut seedlings	4058 ..
Guava and fruit plants	315 ..
Mango graft	841 ..
Coffee seedlings	1178 ..
Cashew seedlings	400 ..
Pepper cuttings	6543 ..
Banana suckers	1254 ..
Vegetable seeds	21 kg
Cowpea seed	60 kg
<i>Erithrina</i> standards	630 Nos
Fish fingerlings	27800 ..
Fish feed	600 kg

Goat	69 Nos
Feed tray	148 ..
Chicks	3832 ..
Ducks	8 ..
Poultry feed and cattle feed	27695 kg
Poultry cage implements	79 Nos
	126 ..
Honey-bee hives	60 ..

### NATIONAL DEMONSTRATION PROJECT

The object of the scheme is to convincingly demonstrate to the farmers the production potentialities of every unit area of land by using high yielding varieties of crops and by adopting multiple cropping programme and package of practices such as balanced use of fertilizers, effective water management techniques, plant protection measures and other agronomic practices.

Twenty five demonstrations were conducted during the year under report. Paddy-pulse cropping pattern was taken up at eight centres. Demonstrations on tapioca with groundnut or horsegram as companion crops were successfully laid out at seven centres. Ten marginal farmers were selected under the "entire farming system - a concept" demonstration in which a combination of production enterprises, crops, livestock, fish, poultry, etc. were involved. The farm development programme was planned in such a manner as to utilize the available resources for deriving maximum profit.

### DRY FARMING SCHEME

The object of the scheme was to find out suitable cropping patterns for Kozhinjampara-Eruthiampathy area in Chittoor Block of Palghat district. Five experiments using different cropping patterns were tried at five locations in cultivators fields. The following cropping patterns were found to be economic, profitable and suitable for the drought prone area:

Relay cropping of cotton, ten days before the harvest of groundnut.

Relay cropping of tapioca, one month after the sowing of groundnut was found highly remunerative even under adverse weather conditions.

Raising paddy variety 'Annapoorna' or 'Suvarnamodan' under delayed monsoon conditions.

Planting of tapioca alone in April-May proved to be most profitable.

The new pattern found suitable for the drought prone area in Kozhinjampara and Eruthiampathy area has been included in the Package

of Practices, 1981. The feasibility of raising tapioca under rainfed conditions in the Sugar mill area at Chittoor will have an added advantage as the starch produced can be utilised for the manufacture of spirit.

#### **NATIONAL SERVICE SCHEME**

##### **Regular activities**

##### *College of Agriculture, Vellayani*

The student strength allotted to this unit for 1980-81 was 225.

The community centre of this unit at Keezhoor continued to function with facilities for reading newspapers, magazines, pamphlets, leaflets etc. till December, 1980. Facilities were also provided for indoor games in the Community centre. The centre was shifted to Grama Vikasana Samithy at Kakkampoola during January 1981. The volunteers took classes for the illiterates at Gram Vidya Kendra at Keezhoor and to the participants of the NCERT Educational programme. Two film shows were conducted at the Community Centre. Posters on modern agricultural practices were displayed in the adopted village and in the Community Centre.

The Volunteers helped in the construction of the stadium and in the conduct of the 7th Kerala Agricultural University Inter Collegiate Athletic Meet at the Agricultural College, Vellayani from 13th to 15th June, 1980.

Cleaning campaign was carried out at the hostel premises. They helped in the decoration, and conduct of the College day celebrations on 26th June, 1980. In connection with the Hostel Day Celebrations, they rendered their help in cleaning and decorating the hostel premises.

The women volunteers visited the houses in the adopted village and discussed the problems of the housewives.

To make the students aware of the "world conservation strategy" a meeting was arranged on 5th June, 1980. The theme of the meeting was "world conservation for maintenance of life". The volunteers also attended a convention on "World conservation" at the V. J. T. Hall, Trivandrum on 8th June, 1980.

The Unit celebrated "Vanamahotsava" by planting 300 seedlings in the College campus. A symposium on Vanamahotsava was also conducted on 25th July, 1980.

An amount of Rs. 214.15 was collected towards the Tripura Chief Ministers' Relief Fund and sent to him on 10-7-1980.

A blood grouping campaign was arranged on 1-8-1980 with the help of Sree Chitra Thirunal Medicinal Centre, Trivandrum and a list of 91 blood donors was maintained so as to donate blood as and when required. Two volunteers donated blood for operation at Medical College Hospital, Trivandrum.

Independence day was celebrated by hoisting National Flag at the Community Centre and distributing sweets to children.

In connection with the 'Onam' celebrations, "Athappoovical" was done for 10 days from August 19th to 24th at the Community Centre and a sports competition was conducted for the local youth on 24th August, 1980.

The volunteers extended help to the NSS Unit of University College Trivandrum in raising a garden in the University College campus.

The international Literacy Day was celebrated on 8th September, 1980 by giving publicity on the importance of eradication of illiteracy. Posters were displayed in the community centre and in the adopted village to publicise the importance of literacy. An exhibition of books for the neoliterates was arranged at Gandhi Smaraka Nidhi

In order to ensure co-operation from local people, a samithy called "National Service Scheme Pravarthaka Samithy" with Shri. B. J. Vijayan as president and Shri. Y. Prasad as Secretary was organised with nine members. This samithy will help the NSS Unit in its activities in the village.

#### *College of Horticulture, Vellanikkara*

The student strength allotted to this unit was 175 during 1980-81. The volunteers taught the villagers of Mullakkara village the improved agricultural practices. Eradication of dowery and other social evils were also stressed in the discussions. The villagers were advised to keep the road sides and footpaths free of weeds, bushy growth etc. and to keep the house premises clean. They were advised to actively participate in the "Vanamathotsava" programmes by planting fruit plants and other seedlings. In order to improve their economic condition, the villagers were requested to rear chicks and raise kitchen gardens. The importance of family planning and child care were taught to them.

Coconut seedlings, planting materials and chicks were distributed to the farmers.

Blood grouping campaign was conducted and blood was donated to the patients at the District Hospital, Trichur. A medical camp was conducted at the Harijan colony, Kallayi on December 1980. The Medical Officer of the P. H. Centre, Vellanikkara, and the Medical Officer of Viyoor Central Jail examined 90 harijans of the colony and gave medicines free.

#### *College of Veterinary and Animal Sciences, Mannuthy*

NSS activities in this unit were undertaken by the volunteers numbering 200.

The unit has organised a 'Karshaka Seminar' on 8th and 9th April, 1980 at L. P. School, Thanikudam. A sterility camp was also arranged along with the seminar and 55 animals were examined and treated.



Seventy animals were protected against Hemorrhagic Septicemia. Thirty five samples were examined and appropriate medicines given. The volunteers took part in the discussion class organised during the seminar.

A film on poultry farming was shown at the Madakkathara village.

Blood grouping campaign was organised to identify blood donors. Blood was donated periodically to the patients at the District Hospital, Trichur. In the exhibition organised in connection with the Silver Jubilee Celebration of this College, a stall was arranged to examine the blood of the visitors. The NSS Volunteers assisted local doctors in the programmes of investigation of health of school children. Eighteen NSS volunteers donated blood on different occasions at the District Hospital, Trichur and Maternity Hospital, Trichur.

The volunteers visited farmers houses at Thanikudom, Ackarapuram and Madakkathara, took classes on proper management of animals, animal husbandry and poultry keeping.

Ranikhet disease vaccinations were taken for the birds and more than 2100 birds were protected against this disease.

The volunteers actively participated in rabies vaccination campaign arranged at Trichur on behalf of Trichur Municipality and Department of Animal Husbandry on 12th and 13th July, 1980.

Cleaning campaign was organised at the premises of Veterinary College and Veterinary Hospital, Mannuthy.

When the labourers entered on strike on 14.8.1980 the volunteers attended the routine works of Livestock Farm and Goat Farm at Mannuthy.

### **Special camping programmes**

#### ***College of Agriculture, Vellayani***

The special camping programme of this unit was conducted from 5th to 9th November, 1980 at the Government Lower Primary School, Poonkulam. There were one hundred and twenty five campers including forty seven women volunteers. The theme of the camp was "youth for rural reconstruction".

The camp was inaugurated by Shri. Janardhanan Pillai, Director, Gandhi Smaraka Nithi, Trivandrum on 5th November, 1980 in a meeting presided over by Prof. M. M. Koshy. Shri. Janardhanan Pillai, stressed the need for the involvement of professional college students in the rural reconstruction work. Shri. K.C. V. K. Raja, Youth Officer National service scheme, Regional Centre, Trivandrum addressed the volunteers. Dr. Skariah Oomen, Programme Officer, National service Scheme welcomed the gathering and Shri. Reghulal proposed vote of thanks.

The major target of the camp was the construction of a road of one kilometer distance connecting the college of Agriculture and

Venganoor road. The road is now fit for vehicular traffic. About 300 families are benefited by the new road and it will cut short the distance to Venganoor by one km. from Keezhoor. The co-operation of the Villagers made the work a success. This new road changed the very face of this area and is undoubtedly going to become a path for progress of this area.

The various discussions held in connection with the camp provided a unique opportunity to the peasant community of the area to understand the latest technology in the field of agriculture, economic milk production and cattle management. The important crops of the area like coconut, tapioca, banana and rice were taken up for discussions. Scientific methods of culture, protection from insect pests and diseases etc. were explained to the farmers in very simple and detailed manner. It provided an occasion for the farmers to get their doubts cleared by the technical experts.

Experts in the Animal Husbandry field provided tips to boost up milk production. The do's and don'ts on cattle management were discussed elaborately. The staff members of the Animal Husbandry Division of the College of Agriculture led the discussion on 'Economic milk production'. The intense curiosity shown by the villagers were encouraging. The calf show organised provided a sense of competitive mentality among the small farmers of the area. Farmers came with their calves to get recognition for their tasks and interest in cattle growing. The calves exhibited were grouped to three classes (below six months old, between six months to eighteen months, above eighteen months). First and second prizes were given for each group. Shri. K. C. V. K. Raja, youth Officer gave away the prizes.

Yet another discussion which was worth mentioning was the one led by Shri. Paul Karipurath and Shri. Lukose of the Gandhi Smaraka Nidhi. This was mainly meant for the campers. This discussion opened new dimensions for rural re-construction.

A free medical camp organised in co-operation with the Medical College NSS Unit attracted the villagers to the camp. The experts from the Medical College, Trivandrum conducted the medical check up of patients and 500 patients were examined. Medicines worth about Rs. 2000/- were distributed free of cost. Immunization for children was also carried out wherever necessary.

During the camp, the volunteers conducted a socio-economic survey on the social evils like the alcoholism and dowry system. The transportation problems were also considered in the survey. About 60% of the people felt difficulties in going to Trivandrum city the sole catering place for their needs which is 11 km. away.

During the camp, film shows and cultural programmes were organised. Family Planning Association of India and the Extension Department of the College of Agriculture screened films about family planning, nutrition, child care and new horizons of Agriculture at the camp. Cultural programmes were staged by camp members, villagers and Poonkulam L. P. S. students under the auspices of the Director of Field Publication, Government of India. "Ganamela" on family Welfare was also conducted.

The valedictory function of the camp was held in the evening of 9th November 1980. The meeting was presided over by Prof. V. Gopinathan Nair, Programme Officer. Dr. Skariah Oommen, welcomed the gathering.

Sri. S. P. Jayachandran, volunteer secretary presented a report of the camp. The valedictory address was delivered by Sri. P. T. Bhaskara Panicker who pointed out the misuse of the funds allotted by the Government for the uplift of the rural people. The funds instead of going to the hands of the real and needy, is often going to the hands of the middle class people. He felt that it is the duty of the NSS volunteers to see that whatever funds available is reaching the desirable ones. Dr. E. T. Jacob stressed the importance of cultivating the sense of hygiene among the rural people. Lady volunteer secretary Sophy P. Mathew proposed vote of thanks.

#### *College of Horticulture, Vellanikkara*

The ten-day special camping programme was conducted at the N. S. L. P. School, Madakkathara with 65 volunteers (35 boys 30 girls) from 21st December to 29th December, 1980. The camp was inaugurated by Sri. Raghavan Puzhakkadavil, MLA. The meeting was presided over by Dr. P. C. Sivaraman Nair, Associate Dean, College of Horticulture. Sri. K. R. Chakunni, Sri. K. K. Surendran and Sri. Kunhittyochothachan spoke on the occasion.

As a preliminary work, the NSS volunteers conducted a survey regarding the socio-economic and cultural status of the people of Madakkathara Village, Mullakkara Harijan colony and Kallayi colony.

The important work done by the NSS volunteers was the construction of a one kilometer road having from N.S.L.P. School, Madakkathara to the Cashew Research Station, Vellanikkara. Another major work was the collection of soil samples from the cultivators' field in the village near the main campus of the University. They also arranged bunchy-top eradication campaign, rodent control campaign and distribution of vegetable seeds and other planting materials in the adopted village at Mullakkara. The farmers of the adopted village were given technical guidance to maximise production.

An Agricultural seminar was arranged on 27-1-81. Eighty five farmers of the village participated in the seminar. The seminar was inaugurated by Sri. Kunhan Raja, Addl. Director of Agriculture. The

meeting was presided over by Sri. U. Unnikrishnan Nair, Asst. Director of Agriculture. Programme Officer Dr. P. Balakrishna Pillai welcomed the gathering and Miss. Usha K. E., extended the vote of thanks. Dr. M. Aravindakshan, Dr. Abicheeran, Dr. T. V. Viswanathan, Dr. P. Balakrishna Pillai and Sri. K. R. Haridas took classes on the various topics such as improved cultivation practices of various crops, plant protection measures, fertilizer application etc.

A medical camp was organised on 21-1-'81 at Kallayi, Harijan Colony. The Medical Officer of the P. H. Centre, Vellanikkara and the Medical Officer of Viyor Central Jail examined 90 harijans of the colony and gave medicines free.

Discussion classes were held by Sri. P. S. Gangadharan, Dist. Information Officer, Sri. K. S. Sasidharan, Field Publicity Officer, Rev. F. Augustine Akkara and Sri. K. C. V. K. Raja, NSS Youth Officer.

On all the ten days of the camp, film shows and other cultural programmes were arranged for the local people. The NSS students of the college and the three clubs of Madakkathara village and Kallayi Harijan Colony took active part in presenting various items in the variety entertainment programme. Film shows were arranged by the Field Publicity Officer, District Information Office and the Kerala Agricultural University.

At the valedictory function, Dr. P. B. Pillai, programme officer presented the report on the various activities during the camp. Sri. N. Kaleeswaran, Vice Chancellor was the chief guest who expressed his appreciation in the work of the NSS volunteers. Dr. M. Krishnan Nair, Rev. F. Augustine Akkara, Dr. P. C. Sivaraman Nair, Sri. P. Narayanan and Sri. K. C. V. K. Raja, spoke on the occasion. Sri. G. Sudarsanan, NSS Secretary welcomed the gathering and Sri. K. Sankaran Kutty Menon, Panchayat Executive Officer proposed vote of thanks.

#### *College of Vety. and Animal Sciences, Mannuthy*

The special camping programme of NSS was held from 5th to 11th January 1981. This camp was inaugurated by Dr. M. Krishnan Nair, Dean on 5-1-1981. Mr. J. D. Mookan presided over the function. The Programme Officer welcomed the distinguished guest to gathering. Dr. P. S. Pushkaran spoke on the occasion.

The opportunity was utilised for road construction and repair. Three roads were repaired. Ranikhet disease vaccination was conducted and triple antigen vaccination campaign at Krishnapuram and Ollukkara was organised. A few coconut seedlings was distributed to the farmers. Dr. K. C. Panicker, Sri. P. S. Gangadharan, Dr. Jacob V. Cheeran, Sri. K. C. V. K. Raja and Dr. Raju lead the discussion classes in the evening. NSS volunteers participated in the seminar on elephants held under the auspices of the S. P. C. A. They also actively participated in the conduct of the elephant show held on 8th at the Municipal Stadium. ●

## CHAPTER V

# Engineering Wing

The Engineering Wing of the Kerala Agricultural University consisted of the Directorate of Physical Plant with seven sub divisions—three at Vellanikkara, two at Mannuthy, one at Vyttila and one at Vellayani. Sri. N. Sivathanu Pillai (on deputation) was the Director of Physical Plant during the year. The list of staff is given in Appendix III. Control and maintenance of buildings, procurement of items of equipment, vehicles and machinery as well as design and construction of buildings for the University are vested with the Directorate.

Major works taken up during the year, completed items of work and work in progress during 1980-81 are as follows:

Major works taken up during 1980-81

Items of work	Estimate (Rs. in lakhs)
Providing fencing to the remaining portion of 750 <sup>m</sup> facing the N. H. at Mannuthy	1.10
Constructing semi-permanent sheds for Fisheries College, Panangad	5.60
Fabricating, twisting and fixing welded trusses	1.50
Constructing field laboratory at Pudukkottai	1.88
Constructing quarters for Associate Dean (1 No) and Assoc. Prof. (2 Nos) at Main campus, Vellanikkara	3.28
Constructing quarters for Professors, type VI (6 Nos) at Main Campus, Vellanikkara	8.52
Constructing marginal drains, culverts and wire fencing to type II quarters (duplex) at Main Campus, Vellanikkara	1.56
Formation of 'C' road—construction of a culvert at Ch. 300M of 'C' road at Vellanikkara.	0.60
Providing cover slabs for drains in hostel block in Main Campus, Vellanikkara.	0.36
Constructing a pot house at R. R. S., Moncompu	0.26

Items of work	Estimate (Rs. in lakhs)
Constructing lab & library building in Agrl. College at Vellayani.	
Constructing teachers hostel-Vellayani	
Constructing a net house for Nematology section Agricultural College College, Vellayani.	0.27
Construction of a building for Dairy Technology at Mannuthy	6.50
Constructing ladies hostel at Main Campus, Vellanikkara	21.00
Radio Isotope lab building at Main Campus Vellanikkara	8.00
Quarters for Asst. Professor Type IV and Associate Professor Type V at Main campus, Vellanikkara	7.56
Constructing Type VI for Professors 6 Nos. at Main Campus, Vellanikkara	8.52
Construction of G. L. tank and pumphouse for Duplex quarters at Vellanikkara	1.40
Construction of G. L. tank and pump house for hostel block at Vellanikkara	1.26
Construction of fish pond at R. R. S. Vyttila	0.62
The following works were completed during the year 1980-81.	

Items of work	Estimate (Rs. in lakhs)
Constructing a building for Meat Technology at Mannuthy (civil works)	9.00
Constructing residential quarters Type VI (5 Nos ) at Mannuthy	4.50
Construction of inpatient ward to Vety. Hospital Mannuthy	1.64
Construction of brooder house in poultry farm at Mannuthy	1.50
Construction of hatchery building at Mannuthy	1.25
Black topping roads in Mannuthy campus leading to Goat shed	0.54
S. A. B. S. converting to University Press	1.23
Improvements to pig styes at P. B. F., Mannuthy	1.29
Constructing dining block near boys hostel at the Main Campus, Vellanikkara	2.30
Constructing watchman shed and gate at Main Campus, Vellanikkara.	0.51
Providing fencing around the Instructional Farm, Main Campus, Vellanikkara.	1.50
Construction of staff quarters duplex type (25 Nos.) at KAU M., C., Vellanikkara.	10.99
Rice Research Station, Vyttila—Construction of lab/ office building	0.63
Construction of lab building at Pudevypu	
Improvements to glass house at Pampadumipara	0.51
Construction of lab office cum store at A. R. S., Chalakudy	2.25

## CHAPTER VI

# Finance and Accounts

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Sri. P. Rajagopal continued as the comptroller till 7.4.1980. Sri. E. Damodara Marar, Registrar held full additional charge of the post of comptroller during the period from 8.4.80 to 15.6.80. Sri. N. M. Abdul Khadir took charge as the comptroller on 16.6.1980.

The budget for the year was for an income of Rs. 598.08 lakhs and expenditure of Rs. 645.35 lakhs, disclosing a deficit of Rs. 47.27 lakhs. A loan repayment (Rs. 32 lakhs) was due to the Government. Since the resources anticipated were not available in full, the expenditure had to be curtailed. The loan to the Government was also not paid. Thus, the year closed with a balance of Rs. 2.49 lakhs. The main source of income confined to be the grant-in-aid from the state Government and the I, C. A. R.

Two special audits were conducted. Thirty seven fresh Audit Notes issued by the Government Auditor were also processed and action taken.

The Accounts Committee constituted from among its non-official members by the General Council at its meeting held on 30-7-1980 with Professor K. C. Chacko, Kolady Govindankutty and K. S. Vasudeva Sarma, considered the Annual Accounts and Audit Report of the University for the year 1974-75 in nine sittings, examined the various witnesses found necessary and submitted the Report to the General Council on 28-3-1981. The comptroller acted as the Convenor of the Accounts Committee as provided for in the rules.

### GOVERNMENT AUDIT WING

Sri. P. Sekharan Nambiar in the cadre of Deputy Examiner of Local Fund Accounts was the Government Auditor during the year.

Audit of the accounts of the University for the year 1977-78 was completed and Audit Report issued. Audit of the accounts for the year 1978-79 was also taken up during the year and good progress was made. Local verification of records in almost all sub-stations under the University was done. Top priority was also given for the audit of accounts of various schemes functioning in different parts of the State.

## CHAPTER VII

### Estate

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Sri. T. M. Ibrahimkutty continued as the Estate Officer during the period under report. An area of 379.5615 ha. was acquired by the Government of Kerala and handed over to the Kerala Agricultural University on 1-5-1973. An area of 11.8753 ha. was acquired additionally as detailed below:

Pocket D	2.7091	on	8-1-1977
Pocket B	1.5056	on	11-12-1979
Pocket A	3.8536	on	11-3-1981
Pocket C	3.8070	on	11-3-1981

The research schemes under the cashew, pineapple, pepper and Floriculture as well as the Instructional Farm of the College of Horticulture are functioning in the main campus. A total area of 149.3 ha. have been earmarked for the above. An area of 12 hectares have been allotted to the National Bureau of Plant Genetic Resources of the Indian Council of Agricultural Research. An area of 14 hectares have been allotted to the Kerala Agricultural Development Project (KADP). An area of 60 hectares have been earmarked for the Botanical Garden wherein the planting of trees will be carried out in a phased manner. An area of about 20 hectares are covered with tapping rubber trees. These 150 hectares include the non-cleared area earmarked for the Instructional Farm, Pepper Research Scheme and the Botanical Garden.

During 1980-81, a quantity of 44,004.83 kg rubber lace was produced in the factory attached to the estate. A stock balance of 16,610.20 kg of finished rubber lace was on hand on 1-4-1980. An amount of Rs. 6,49,717.50 was received by the sale of 53,000kg of rubber lace. During the year, 983 trees were cut and removed, etching an amount of Rs. 56,242.41. The total expenditure was Rs. 7,59,332.40 against a receipt of Rs. 7,12,524.32. A stock balance of 7,615.03 kg of finished rubber was in stock on 31-3-81. ●





# Appendix I

## MEMBERS OF THE STATUTORY AUTHORITIES

### I THE GENERAL COUNCIL

#### Ex-Officio members

Her Excellency the Governor, of Kerala, Raj Bhavan, Trivandrum.  
Hon'ble Minister for Agriculture, Trivandrum.  
Vice-Chancellor, Kerala Agricultural University, Vellanikkara  
Special Secretary to Government & Agricultural Production  
Commissioner, Government Secretariat, Trivandrum  
Secretary (Development), Government Secretariat, Trivandrum  
Special Secretary (Finance), Government Secretariat, Trivandrum  
Director of Agriculture, Trivandrum  
Director of Animal Husbandry, Trivandrum  
Director of Dairy Development, Trivandrum  
Director of Fisheries, Trivandrum  
Chief Conservator of Forests, Vazuthacaud, Trivandrum  
Registrar of Co-operative Societies, Trivandrum  
Dean, Faculty of Agriculture, College of Agriculture, Vellayani  
Dean, Faculty of Fisheries, College of Fisheries, Panangad  
Dean, Faculty of Vety. & Animal Sciences, College of Veterinary &  
Animal Sciences, Mannuthy  
Director of Extension, Kerala Agricultural University, Vellanikkara.  
Director of Research, Kerala Agricultural University, Vellanikkara  
Director of Students' Welfare,  
Kerala Agricultural University, Vellanikkara -Vacant

#### Elected members

##### Members of the Legislative Assembly (w. e. f. 9-4-80)

Sri. Cyriac John, Kattippara P. O., Thamarassery  
Sri. P. K. Gopalakrishnan, Pushpagiri, Panangad P. O., Trichur  
Sri. M. K. Kannan, Menoth Veedu, Seetharam Mills Lane,  
Poonkunnam P. O., Trichur.  
Sri. Raghavan Puzhekkadavil, Karalam P. O., Irinjalakuda (Via)

##### Representatives of post-graduate students

Sri. Abdul Azeez M., Post-graduate student,  
College of Vety. & Animal Sciences, Mannuthy.  
Sri. Markose V. C., Post-graduate student,  
College of Agriculture, Vellayani.

##### Representatives of under-graduate students

Sri. Harisankar S., B. Sc. (Ag.) student,  
College of Agriculture, Vellayani.

Sri. Mohanan B., B. Sc. (Ag.) student,  
College of Horticulture, Vellanikkara.

**Representative of Diploma & Certificate courses**

Sri. Krishnakumar M. S., Student,  
Diploma in Agricultural Sciences, Institute of Agricultural  
Technology, Tavanur.

From 24-2-1981

Sri. Jojomon, VI Batch D. A. Sc.  
Institute of Agricultural Technology, Tavanur

**Representatives of teachers of Faculties**

Sri. Sivasankara Pillai K., Associate Professor,  
Model Agronomic Research Station, Karamana.

Dr. M. Krishnan Nair, Professor of Pathology,  
College of Vety. & Animal Sciences, Mannuthy.

From 3-10-1980

Dr. M. Soman, Assoc. Professor of Vety. & Public Health  
College of Vety. & Animal Sciences, Mannuthy.

Dr. D. M. Thampy, Professor of Fisheries,  
College of Fisheries, Panangad, Cochin.

**Representative of non-teaching staff**

Sri. Neelakantan Kartha K. M., Senior Grade Livestock Asst.,  
Pig Breeding Farm, Mannuthy.

**Representatives of Presidents of Panchayats**

Sri. Chooriyottil Sethumadhavan,  
President, Alanalloor panchayat,  
Alanalloor, Palghat Dist.

Sri. Surendran K. K., President,  
Madakathara Panchayat, Madakathara P. O., Trichur.

Sri. Ramayya Shetty B. M., President,  
Manjeswar Panchayat, Cannanore Dist.

Sri. Raveendran N., President,  
Kundara Panchayat, Quilon District.

**Representatives of Mayors of Municipal Corporations and  
Chairmen of Municipal Councils**

Sri. Mohammed Kunju A., Chairman,  
Attingal Municipal Council, Attingal, Trivandrum Dist.

**Members nominated by the Chancellor**

**Agricultural Scientists**

Dr. P. N. C. Pillai, Agricultural Specialist,  
Agriculture (PP & M Cell) Dept.,  
Y. W. C. A. Building, Trivandrum.

Dr. Abi Cheeran,  
Professor of Plant Pathology,  
College of Horticulture, Vellanikkara, Trichur.

**Farmers**

Sri. C. P. Narayanan, Editor, Chintha Weekly,  
28/1012, Kunnumpuram, Trivandrum.

Sri. E. Gopalakrishna Menon,

Ex. M. L. A. Ayyanthole, Trichur-3.

Sri. P. Z. Joseph, M. A., B. Ed.,

Kavalam P. O., Alleppey Dist.

Sri. P. R. Francis, Ex. M. L. A., Porathur House,  
Ollur P. O., Trichur.

Sri. Kolady Govindankutty, Advocate,

Ponnani, Malappuram District.

**Non-official representatives****Co-operation**

Sri. O. Lukose, M. L. A.,

Kappumthala P. O., Kaduthuruthy.

**Fisheries**

Sri. V. V. Saseendran, Advocate,

Karunagappally.

**Animal Husbandry**

Sri. K. S. Vasudeva Sharma, Shankaranilayam,

Venmony P. O., Chengannoor, Alleppey Dist.

**Plantation industry**

Sri. George J. Mathew, Ex. M. P.,

Kottickal P. O., Kottayam. (till 27-11-80)

From 12-3-'81

Sri. P. C. Joseph, Ex. M. L. A.,

Ponthad House, Vāzhithala P. O.

**Women Social worker**

Smt. Vijaya S. Nair, Ayiram Thoppu,

Karikkakom, Kadakampally, Trivandrum.

**Engineer who has specialised in Agrl. Engineering or irrigation**

Sri. K. Bharathan, 16/1506, Kavuvila Lane,

Jagathy, Trivandrum.

**Educationalist**

Prof. V. S. Ouseph,

"Beth", Nalanchira, Trivandrum.

**Representatives of agricultural labour**

Sri. K. P. Joseph, (Expired on 13-1-'81)

Kayalparambil Veedu, Ponga P. O.,

Moncompu, Alleppey Dist.

From 12-3-'81

Sri. G. Sudhakaran Nair, Nallaveetil,

Vedarpla, Karimulakkal P. O., Charummood (via) Alleppey.

Sri. R. Narayanan Athippotta,  
 Tarur, Palghat Dtstrict, (till 26-9-80)  
 From 12-3-81  
 Sri. K. P. Chelly, Konnakothu Palliyalil,  
 P. O. Mankada, Malappuram.

**Representative of plantation labour**

Sri. K. M. Shahul Hameed. M. P. E. Union Office,  
 Palianmala P. O., Idukki District,

**Representatives of Universities**

**Kerala University**

Sri. K. C. Chacko, Prof. of Physics,  
 C. M. S. College, Kottayam (from 29-6-80)

**Calicut University**

Sri. Krishnan Nair, Member, Pilicode Panchayat,  
 P. O. Pilicode, Cannanore Dist. (from 29-9-80)

**Cochin University**

Sri. C. T. Samuel, Dean,  
 Faculty of Marine Sciences, University of Cochin

**Representative of ICAR**

Dr. Silas, E. G. Director,  
 Central Marine Fisheries Research Institute,  
 Gopala Prabu Road, Ernakulam

**II THE EXECUTIVE COMMITTEE**

Sri. N. Kaleeswaran, Vice-Chancellor	Chairman
Secretary to Government & Agricultural Production Commissioner, Trivandrum	Member
Secretary to Government (Finance), Trivandrum	"
Secretary to Government, Development Dept., Trivandrum	"
Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute, Cochin	"
Dr. M. J. Sebastian, Dean, Faculty of Fisheries, College of Fisheries	"
Dr. D. M. Thampy, Professor, College of Fisheries	"
Sri. O. Lukose, M. L. A. Kaduthuruthy	"
Sri. C. P. Narayanan, Editor, Chintha Weekly	"
Sri. P. R. Francis, Ex. M. L. A., Porathur House, Ollur P. O. Trichur	"

Sri. K. P. Joseph, Kayalparambil Veedu	..
Ponga P. O., Moncompu, Alleppey Dist	..
Sri. G. Sudhakaran Nair, Nallaveetil,	..
Karimulakkal P. O., Alleppy Dist. (from 12-3-81)	..
Registrar Kerala Agricultural University	Convener

### III THE ACADEMIC COUNCIL

#### Ex-officio members

Vice Chancellor	Chairman
Pro-Vice-Chancellor, if any	Member
Dean, Faculty of Agriculture	..
Dean, Faculty of Vety. & Animal Sciences	..
Dean, Faculty of Fisheries	..
Associate Dean, College of Horticulture	..
Director of Research, KAU	..
Director of Extension, KAU	..
Registrar, Kerala Agricultural University	..
Director of Agriculture, Trivandrum	..
Director of Animal Husbandry, Trivandrum	..

#### Members nominated by the Chancellor from among the Heads of Departments

Prof. A. G. G. Menon, Professor of Agrl. Extension, College of Agriculture, Vellayani	..
Dr. M. M. Koshy, Professor (Research Co-ordination), College of Agriculture, Vellayani	..
Sri. A. Venugopalan, Professor, (Research Co-ordination) College of Vety. & An. Sc., Mannuthy	..
Sri. K. Radhakrishnan, Professor, Department of Anatomy, Collage of Vety. & Animal Sc. Member Mannuthy.	..
Sri. P. K. Abdulla, Professor, Department of Microbiology, College of Veterinary & Animal Sciences, Mannuthy.	..

#### Members nominated by the Chancellor from among the staff of research stations

Dr. C. C. Abraham, Professor of Entomology, AICRP on Biological Control of crop pests, Vellanikkara.	..
Dr. A. Rajan, Professor of Pathology, ICAR Scheme on Incidence, Etiology & Pathology of Tumours of Ethmoid in Domestic Animals, Mannuthy.	..

**Elected members from among post-graduate & research students**

- Sri. Thomas Biju Mathew, M. Sc. (Ag.) Student,  
College of Agriculture, Vellayani.  
Sri. P. J Joseph, Ph. D. Student,  
College of Agriculture, Vellayani.

**Members elected by the teachers (other than Deans of Faculties)**

- Sri. P. D. Vijayagopal, Associate Professor,  
Department of Horticulture, College of Agriculture,  
Vellayani.  
Sri. P. A. Ummer, Associate Professor,  
College of Veterinary & Animal Sciences, Mannuthy.

**Nominated members from among those connected with service in Agriculture**

- Sri. T. P. Seetharaman, Ardra Estate,  
Ponnookkara, Trichur Dist.  
Dr. M. N. Menon, Animal Husbandry Commissioner  
(Retd.) "Anuradha", Trivandrum 685005  
Dr. T. A. Mammen, Director  
Marine Products Exports Development Authority,  
P. B. No. 1708, M. G. Road, Ernakulam-  
Cochin 682016.  
Sri. A. G. Vasavan, Director of Fisheries  
Vikas Bhavan, Trivandrum-1.  
Dr. P. M. Ganapathy, Director,  
Kerala Forest Research Institute, Peechi.

**Representatives from ICAR/its institutes/other Universities/  
well known Scientists**

- Dr. N. M. Nayar, Director  
Central Plantation Crops Research Institute,  
Kasaragod. Member  
Dr. N. Hrishi, Director,  
Central Tuber Crops Research, Institute,  
Trivandrum. "  
Dr. A. Appa Rao, Director of Research,  
Andhra Pradesh Agricultural University,  
Rajendra Nagar, Hyderabad-500 030. "  
Dr. K. J. Joseph, Department of Zoology,  
University of Calicut. "  
Dr. V. Rajagopalan, Director,  
Centre for Agricultural and Rural Development Studies  
Tamil Nadu Agricultural University,  
Coimbatore-641003. "

## IV THE BOARD OF STUDIES

### FACULTY OF AGRICULTURE

Dean, Faculty of Agriculture

Chairman

#### Heads of Departments under the Faculty

(Agronomy, Agrl. Botany, Agrl. Economics, Agrl. Engineering, Agrl. Extension, Agrl. Statistics, Horticulture, Plant Pathology, Soil Science & Agrl. Chemistry, Plantation crops & spices, Olericulture, Pomology & Floriculture, Processing Technology, Plant Breeding) Members

#### Specialists

Dr. K. K. Krishnamoorthy, Dean, Agrl. College & Research Institute, Madurai, Tamil Nadu. "

Dr. A. Appo Rao, Director of Research, Andhra Pradesh Agrl. University, Hyderabad. "

#### Other members

Dr. M. Aravindakshan, Professor, College of Horticulture, Vellanikkara, "

Dr. C. C. Abraham, Professor, College of Horticulture, Vellanikkara. "

#### Student representatives

Member

Sri. K. P. Vasudevan Nair,

Ph. D. Student, College of Agriculture, Vellayani: "

Sri. Ahammed Facel, B. Sc. (Ag.) Student, College of Agriculture, Vellayani. "

#### Special invitees

Director of Research, KAU. "

Director of Extension, KAU. "

### FACULTY OF VETERINARY & ANIMAL SCIENCES

Dean, Faculty of Veterinary & Animal Sciences

Chairman

#### Heads of Departments under the Faculty

Members

(Anatomy, Animal Breeding & Genetics, Animal Management, Animal Reproduction, Dairy Science; Extension, Medicine, Microbiology, Nutrition, Parasitology, Pathology, Pharmacology, Physiology & Bio-chemistry, Poultry Science, Statistics, Surgery, Therapeutics, Veterinary Public Health)

#### Specialists

Dr. C. V. Reddy, Dean, College of Veterinary and Animal Sciences, Andhra Pradesh Agriculture University, Hyderabad. "



Dr. B. S. Kesavamoorthy, Professor of Veterinary Microbiology, University of Agriculture Sciences, Bangalore.

**Other Members**

Dr. C. R. Ananthasubramaniam,  
Professor, College of Veterinary and Animal Sciences, Mannuthy.

Dr. A. Rajan, Professor,  
College of Veterinary and Animal Sciences,  
Mannuthy.

**Special invitees**

Director of Research, KAU.

Director of Extension, KAU.

## Appendix II

### SUB COMMITTEES OF THE EXECUTIVE COMMITTEE

#### I FINANCE COMMITTEE

Vice-Chancellor	Chairman
Secretary to Government (Finance)	Member
Secretary to Government & Agricultural Production Commissioner	"
Sri. K. S. Vasudeva Sarma (till 19-9-80)	"
Sri. O. Lukose (from 19-9-80)	"
Comptroller, Kerala Agricultural University Vellanikkara.	Convener

#### II ESTABLISHMENT COMMITTEE

E. Gopalakrishna Menon	Chairman
Sri. P. R. Francis M. L. A.	Member
Prof. V. S. Ouseph	"
Sri. K. S. Vasudeva Sarma	"
Dr. N. Sadanandan	"
Dr. M. Krishnan Nair	"
Registrar	Member & Secretary

#### Reconstituted with effect from 19-9-80 as

Sri. C. P. Narayanan	Chairman
Sri. P. R. Francis. Ex. M. L. A.	Member
Sri. K. P. Joseph (upto 13-1-'81)	"
Sri. G. Sudhakaran Nair (from 12-3-'81)	"
Sri. O. Lukose M. L. A.	"
Dr. M. J. Sebastian, Dean, Faculty of Fisheries	"
Dr. D. M. Thampy, Prof of Fisheries	"
Registrar	Convener

#### III STUDENTS WELFARE COMMITTEE

Sri. P. R. Francis M. L. A.	Chairman
Sri. E. Gopalakrishna Menon	Member
Sri. K. S. Vasudeva Sarma	"
Pro. V. S. Ouseph	"
Dr. M. Krishnan Nair	"

#### Reconstituted w. e. f. 19-9-80 as:

Sri. P. R. Francis, Ex. M. L. A.	Member
Sri. K. P. Joseph (till 13-1-'81)	"
Sri. G. Sudhakaran Nair (from 12-3-'81)	"

Sri. O. Lukose, M. L. A.	..
Sri. C. P. Narayanan	..
Dr. D. M. Tamy	Member—Convener

#### IV PLANNING & DEVELOPMENT COMMITTEE

Vice-Chancellor	Chairman
Special Secretary to Government (Agrl. Dept.) and Agricultural Production Commissioner	Member
Sri. K. S. Vasudeva Sarma	..
Prof. V. S. Ouseph	..
Dr. N. Sadanandan, Dean, College of Agriculture, Vellayani	Member—Convener

#### Reconstituted w e. f. 19-9-'80 as follows;

Vice-Chancellor	Chairman
Special Secretary to Govt. (Agrl. Dept.) & Agrl. Production Commissioner	..
Sri. O. Lukose, M. L. A.	..
Sri. C. P. Narayanan	..
Dr. D. M. Thampy, Professor of Fisheries (The Director of Research or/and Dean (s) may also be invited specially, whenever considered necessary)	Member—Convener

#### V SPORTS BOARD

Sri. N. Kaleeswaran, Vice-Chancellor	Chairman
All Officers of the University	Members
Registrar	Member
Dr. N. Sadanandan, Dean, College of Agriculture, Vellayani	..
Dr. P. G. Nair, Dean, College of Vety. & Animal Sciences, Mannuthy	..
Dr. P. C. Sivaraman Nair, Assoc. Dean College of Horticulture, Vellanikkara	..
Dr. M. Krishnan Nair, Professor, Department of Pathology, College of Vety. & Animal Sciences, Mannuthy	..

#### Reconstituted w e. f. 19-9-80 as:

Vice-Chancellor	Chairman
Chairman of the Students Welfare Committee	Member
Deans and Assoc. Dean (Hort.)	Members
Registrar	Member
One Professor from each College to be nominated by the Vice-Chancellor	Members
Dr. D. M. Thampy, Professor of Fisheries	Member
Secretary, Athletic Association of the respective Colleges/Institute	Members

Student Members in the General Council	Members
Director, Institute of Agrl. Technology	Member
Junior Asst. Professor (Physical Education)/	Members
Officer i/c of Sports (where no Jr. Asst. Prof. in Physical Education is available)	"
Deputy Director of Students Welfare (Sports & Games)	Member- Convener

#### VI STATUTE SUB COMMITTEE

Sri. V. Gopalakrishna Kurup	Chairman
Prof. V. S. Ouseph	Member
Prof. T. P. Mohamed Kunhi	"
Dr. M. Krishnan Nair	"
Sri. N. Rajappan Nair	"
Registrar	Convener
<b>Constituted w. e. f. 19-9-80 as:</b>	
Sri. C. P. Narayanan	Chairman
Sri. K. S. Vasudeva Sarma	Member
Prof. V. S. Ouseph	"
Prof. K. C. Chacko	"
Sri. O. Lukose M. L. A.	"
Dr. D. M. Thampy, Prof. of Fisheries	"
Registrar	Convener

#### VII WORKS COMMITTEE

constituted w. e. f. 19-9-1980)

Vice-Chancellor	Chairman
Sri. P. R. Francis, Ex. M. L. A.	Member
Sri. K. P. Joseph (till 13-1-81)	"
Sri. G. Sudhakaran Nair (from 12-3-81)	"
Dean, Faculty of Fisheries	"
Director of Physical Plant	Convener

#### VIII RESEARCH REVIEW SUB COMMITTEE

(constituted w. e. f. 19-9-80)

Vice-Chancellor	Chairman
Sri. P. R. Francis, Ex. M. L. A.	Member
Sri. K. P. Joseph (till 13-1-81)	"
Sri. G. Sudhakaran Nair (from 12-3-81)	"
Sri. O. Lukose, M. L. A.	"
Sri. C. P. Narayanan	"
Director of Research	Convener

(It was decided that the Research Review Sub Committee should visit major Research Stations and Colleges for an assessment/evaluation [of the research operations in the Stations/College departments.]

## IX THE RESEARCH COUNCIL

Reconstituted with effect from 1-1-1981

### Proper Research Council members

Vice-Chancellor	Chairman
Director of Research	Secretary
Director of Extension	Member
Dean, Faculty of Agriculture	"
Dean, Faculty of Veterinary & Animal Sciences.	"
Dean, Faculty of Fisheries.	"
Asso. Dean, College of Horticulture	"
Agricultural Production Commissioner, Govt. of Kerala.	"
Dr. E. G. Silas, Director, CMFRI, Cochin	"
Director of Research, Tamil Nadu Agricultural University.	"
Director of Research, Andhra Pradesh Agricultural University, Hyderabad.	"
Director of Research, University of Agricultural Sciences, Bangalore.	"
Sri. O. Lukose, Member, Executive Committee	"
Sri. C. P. Narayanan, Member, Executive Committee	"
Sri. C. T. Samuel, Professor University of Cochin.	"
Sri. K. C. Chacko, Professor, C. M. S. college, Kottayam.	"
Sri. C. Krishnan Nair, President, Piliicode Panchayat (General Council member, Kerala Agri. University)	"
Dr. D. M. Thampi, Professor, College of Fisheries (Teacher representative in the General Council, Kerala Agrl. University)	"
For discussion and finalisation of the projects, Faculty-wise, the following members will be co-opted:	

### Agriculture

Professor (Research Co-ordination) Faculty of Agriculture	Convener for Agri Faculty
Director of Agriculture, Trivandrum.	
Sri. K. Koyamu (Retd.) Addl. Director of Agriculture, Calicut	
Dr. P. N. C. Pillai, (Retd.) Addl. Director of Agriculture, Trivandrum.,	
Dr. P. Pavithran, Professor of Botany, University of Calicut.	
Dr. C. R. Muthukrishnan, Dean, Faculty of Horticulture, Coimbatore.	
Sri. P. Suseelan. Addl. Director of Agriculture, Trivandrum.	

Dr. N. Mohanakumaran, Assoc. Director, Kerala  
Agri. University.  
Editor, Agricultural Research Journal of Kerala.

**Veterinary & Animal Sciences**

Professor (Research Co-ordinator) Veterinary & Animal Sciences. (Convener for Animal Science Faculty)  
Director of Animal Husbandry, Trivandrum.  
Director of Dairy Development, Trivandrum.  
Dr. M. S. Sivasubramaniam, Addl. Director of Animal Husbandry, Kerala.  
Associate Director of Research. (Vety. & An. Sc.)  
Kerala Agrl. University.  
Editor, Kerala Veterinary Research Journal.  
Dr. G. Nirmalan, Professor of Physiology,  
College of Veterinary & Animal Sciences.  
Sri. M. N. Menon, Animal Husbandry Commissioner (Retd.) 'Anuradha', Trivandrum-695005.

**Fisheries**

Members will be co-opted as and when projects required to are be finalised.  
In appropriate cases, progressive farmers and others useful for discussions will be invited for attending the meetings as Special Invitees.

**X FACULTY RESEARCH COMMITTEES**

**Agriculture**

Director of Research, Kerala Agrl. University.	Chairman
Dean, Faculty of Agriculture	Member
Assoc. Dean, College of Horticulture	"
Assoc. Director of Research (AR & T)	"
Assoc. Director of Research (Plg.)	"
Assoc. Director of Research (M & E)	"
Heads of Departments in the Faculty of Agriculture	"
Project Co-ordinators in the Faculty of Agriculture	"
Director, Institute of Agricultural Technology, Tavanur.	"
Sri. N. Rajappan Nair, Assoc. Professor	"
R. R. S. Moncompu.	"
Dr. M. M. Koshy, Professor (Res. Co-ordination)	Secretary & Convener

**Veterinary & Animal Sciences**

Director of Research, Kerala Agricultural University	Chairman
---	----------

Dean, Faculty of Veterinary & Animal Sciences	Member
Assoc. Director of Research (V & A. S.)	"
Heads of Departments in the Faculty of Veterinary & Animal Sciences	"
Project Co-ordinators in the Faculty of Veterinary & Animal Sciences	"
Assoc. Professor, Livestock Research Station, Thiruvazhamkundu.	"
Assoc. Professor, Cattle Breeding Farm Thumburmuzhi	"
Fodder Research Officer, Mannuthy	"
Dr. A. Venugopalan, Professor (Research Co-ordination)	Secretary & Convener

#### XI VARIETY EVALUATION COMMITTEE

Director of Research, Kerala Agri. University	Chairman
Director C. T. C. R. I., Trivandrum or his nominee	Member
Director, C. P. C. R. I., Kasargod or his nominee	"
Director of Agriculture, Trivandrum or his nominee	"
Director of Extension, Kerala Agri. University	"
Professor of Agronomy, College of Agriculture, Vellayani	Member..
Professor of Plant Pathology, College of Agriculture, Vellayani	"
Professor of Agricultural Botany, College of Agriculture, Vellayani	"
Professor of Horticulture, College of Agriculture, Vellayani	"
Professor of Entomology, College of Agriculture, Vellayani	"
Assoc. Professor, Rice Resarch Station, Pattambi	"
Assoc. Professor, Coconut Research Station, Pilicode	"

#### XII THE POST-GRADUATE COMMITTEE

Vice-Chancellor	Chairman
Dean, Faculty of Agriculture	Member
Dean, Faculty of Vety.	"
Director of Extension	"
Director of Research	"
Assoc. Dean, College of Horticulture	"
Dr. A Venugopalan, Professor (Research Co-ordination), Faculty of Veterinary & Aimal Science	"
Dr. M. M. Koshy, Professor (Research Co-ordination), Faculty of Agriculture	"
Registrar	Convener

## Appendix III

### LIST OF STAFF AT THE HEAD QUARTERS

Vice-Chancellor	:	Sri. N. K. Kaleeswaran, IAS.
<b>Registrar's Office</b>		
Registrar	:	Sri. E. Damodara Marar
Asst. Registrar (Academic)	:	Sri. C. K. Ramakrishnan
Asst. Registrar (Admn.)	:	Sri. K. Ramakrishnan Upto 28-8-80 Smt. P. Lekshmikutty Amma 29-8-80 to 31-3-81
Labour Officer	:	Sri. C. N. Muraleedharan Nair (Also Dy. Director, Students Welfare i/c)
Secretary to V. C.	:	Sri. K. U. Abdul Khadir
P. A. to Registrar	:	Sri. A. K. Abdul Khadir
Section Officers-11	:	Sri. T. P. Ponnar Sri. P. K. Ramachandran Nair From 17-7-80 to 31-3-81 Sri. N. Padmanabhan Nair till 13-5-80 Smt. K. Padmavathy From 14-5-80 to 31-3-81 Sri. Lourden Leord Sri. V. K. Balakrishnan Sri. M. Wilson (From 1-4-80 to 31-7-81 Sri. K. Balakrishnan Nair From 4-8-80 to 31-3-81 Sri. O. Vinodakrishnan Sri. A. Basil Sri. P. M. Chandran Sri. Philip, K. Kurian (9/80 to 31-3-81) Smt. K. Subhashini
SeniorGrade Assistant-9	:	Sri. Chandramohanam, K. Smt. Zainaba Beevi. T. A. Sri. P. V. Sreekumaran Sri. K. R. Dileep Kumar Smt. E. K. Bharathy



	Smt. P. V. Nalini
	Smt. K. P. Narayanikutty
	Sri. K. K. Subramonian
	Sri. K. I. Chakkunny
Assistant Gradel-13	Smt. P. T. Thankamoni
	Sri. P. M. Cherukutty
	Sri. P. M. Balakrishnan
	Smt. K. P. Mary
	Smt. V. J. Rosily
	Sri. Rajeew, S. Upto 9/80
	Smt. P. R. Sreedevikutty
	9/80 to 3/81
	Sri. K. K. Satheesan
	Smt. K. P. Sarama
	Sri. N. K. Achuthan
	Sri. C. Rajagopalan
	Sri. P. V. Raveendran
	Smt. Sherly Bai George
	Sri. M. Radhakrishnan
II Grade Assistant-3	Sri. V. Jacob Simon
	Smt. Mercy John
	Sri. Suresh K. R.
Translator -1	Sri. Prakash, K. (From 31-12-80)
Sr. Office Superintendent-2	Sri. P. P. Gangadharan
	Sri. P. Govindankutty Menon
Office Superintendent-2	Sri. K. K. Ramachandran Nair
	(Upto 2/80)
	Smt. Elsy. P. O.
Senior Grade Typist-5	Sri. R. Sadan (9/80 to 3/81)
	Sri. P. I. Itoop
	Sri. K. G. Balakrishnan
	Sri. P. Haridasan
	Sri. V. P. Asokan
Grade I Typist-2	Smt. Mariamma, V. C.
	Smt. K. Leela
Grade II Typist	Smt. K. M. Mary
Duffear (1)	Sri. T. S. Kerala Varman
Duplicator Operator-2	Sri. P. A. Francis
	Sri. A. V. Poullose
Attenders (2)	Sri. T. N. Aravindakshan
	Smt. M. M. Kamani
	(18-12-80 onwards)
Driver Grade I	Sri. Louis, C. T.
Grade II	Sri. M. Mukundan
	Sri. K. A. Mohammedkutty

Cook-cum-caretaker	:	Sri. P. Sankara Pillai
Peon-6	:	Sri. T. K. Chandran
		Sri. T. R. Balakrishnan
		Sri. C. A. Muthu
		Sri. C. Madhusoodanan Nair
		Sri. E. K. Padmanabhan
		Sri. A. Jayagovindan
Gardener V. C.'s residence	:	Sri. Antony, P. V
Sweeper	:	Smt. Sobha, S.
Gurkha Watchman	:	Sri. Dirjan Bahadur Singh
Sweeper-cum-Scavanger	:	Smt. K. K. Karthiyani
		Smt. P. V. Devoo
		Smt. T. Mariyam
Watcher-cum-Gardener	:	Sri. V. J. Balan
<b>Directorate of Research</b>		
Director of Research	:	Sri. P. N. Pisharody, Professor, Project Co-ordinator (Rice) held additional charge upto 8-3-1981 Dr. P. C. Sivaraman Nair taken over charge on 9-3-81
Professor-Project	:	Sri. P. N. Pisharody, Project Co-ordinator (Rice)
Co-ordinator-3		Dr. K. P. Rajaram, Project Co-ordinator (Soils)
		Dr. C. R. Anantha Subramaniam Project Co-ordinator (Cattle & Buffaloes assumed charge on 19-4-80)
Assoc. Professor-1	:	Sri. P. G. Veeraraghavan upto 30-11-80
Section Officer-1	:	Sri. T. N. Sankunny
Sr. Grade Assistant-2	:	Smt. D. A. Syamala (upto 28-4-80) Smt. V. V. Radhamma (upto 12-5-80) Sri. M. N. Sasidharan Sri. K. K. Radhakrishnan (since 17-5-80) Sri. V. Viswambharan
Assistant Grade I-1	:	Smt. K. Thankom
Assistant Grade II-1	:	Sri. S. Ramachandran Nair
Typist Grade I-4	:	Smt. P. Subhashini Smt. C. B. Merlin Sri. K. K. Damodaran Smt. P. R. Sarojini (From 20-1-81) Smt. V. K. Rosey (From 1-12-80)

	Smt. M. L. Sosannam (From 1-12-80 to 20-1-81) Smt. C. J. Catherine
Senior Grade Typist Driver-1	:
Peon-1	: Sri. T. K. Govindan
Assoc. Directors <b>NARP</b>	: Sri. M. K. Muraleedharan
Planning	: Dr. N. Mohanakumaran (from 1-12-80)
Monitoring & Evaluation	: Dr. C. C. Abraham (from 17-3-81)
Adaptive Research & Trg.	: Prof. P. N. Pisharody (from 18-3-81)
<b>University Post</b>	
Vety. & Animal Sciences	: Dr. R. Kalyanasundaram (from 1-12-80)
Photographer-cum-artist (NARP)	: Vacant
<b>Directorate of Extension</b>	
Director of Extension	: Dr. V. S. S. Petti
Asst. Registrar (Tech.)-1	: Dr. T. R. Sankunny
Public Relations Officer-1	: Vacant
Associate Professor-6	: Sri. P. Ramachandran Nair Sri. K. C. Varghese Sri. A. I. Thomas Dr. E. Thajudeen (till 16-3-81) Smt. Santhakumari Dr. P. S. Pushkaran
Asst. Professor-8	: Sri. P. Reghunath (from 3-2-81) Smt. S. Sumangalakutty Amma Smt. G. Droupathy Devi Sri. A. K. George Smt. M. K. Sheela Sri. O. J. George Dr. A. Jalaluddin Dr. C. Bhaskaran
Junior Asst. Professor-4	: Sri. R. Gopinath Sri F. M. H. Khaleel Sri. S. Bhaskaran Sri. P. Rajendran
Press Manager-1	: Sri. K. Rajappan
Chief Artist-1	: Sri. G. Gopinathan Nair
Language Editor-2	: Smt. K. Mrudula Devi One post vacant

**Directorate of Physical Plant**

Director of Physical Plant : Sri. N. Sivathanu Pillai  
Personal Asst. to D. P. P. : Sri. C. George Mathew  
Assistant Engineer-2 : Vacant

**Execution**

Architect-1 : Vacant  
Junior Architect-1 : Vacant  
Executive Engineer-1 : Sri. S. J. Mathew  
Asst. Executive Engineer-7 : Sri. K. J. Achuthan  
Sri. P. O. Thomas  
Sri. H. Narayanan Swamy  
Sri. P. J. Mathai  
Sri. P. Ashokan (till 4-8-80)  
Sri. E. K. Lalithambaran  
(till 17-10-80)

Assistant Engineer-16 : Sri. P. M. David  
Sri. C. Jose Mathews  
Sri. T. Sreedhara Menon  
Sri. N. Shajahan (from 5-9-80)  
Smt. V. Savithry (from 20-6-80)  
Sri. P. Karunakara Panicker  
(from 11-1-80)  
Sri. E. K. Gokulan  
Sri. R. Chithambaran Pillai  
Sri. V. Harihara Sudhan Nair  
Sri. P. M. James  
Sri. T. K. Sugathan  
Sri. A. J. Anto  
Sri. K. V. Ramanunni  
Smt. K. R. Sarojini  
Sri. K. S. Alphons  
Sri. M.M. Davy

Draftsman/Overseer-16 : Sri. M. N. Vasudevan Ezhuthassan  
Smt. Felcia Netto  
Sri. V. S. Balan  
Sri. C. C. Devassy  
Sri. P. A. Johny  
Sri. C. L. Jacob  
Sri. M. A. Devassy  
Sri. M. Parameswaran  
Sri. J. Selvanose  
Sri. R. Kumaran Nair  
Sri. Jacob Nesamony

	Sri. K. T. Jacob
	Sri. K. J. George
	Sri. S. Murukesan Achary
	Sri. M. G. Jaya Prakash
	Sri. M. V. Purushothman (till 4-9-80)
Technician Senior Grade-1	: Sri. T. A. Rappai
Electrician-cum-mechanic-1	: Sri. P. K. Vijayan
Assistant Senior Grade-2	: Sri. P. V. Sreekumar
	Smt. M. K. Shylaja
Assistant Grade I-5	: Smt. Joycee
	Sri. P. J. John
	Smt. G. Rema Bai
	Smt. L. Syamala
Typist Grade I-4	: Smt. M. Balamony
	Smt. K. T. Thanka
	Smt. Seemanthiny
	Smt. C. Padmavathy
Assistant Grade II-1	: Sri. Y. Rajas
Draftsman Grade II-1	: Sri. P. Raman
Bull dozar Operator-1	: Sri. P. P. Francis
Road Roller Driver-1	: Sri. M. K. Bhaskaran
Plumber Technician-1	: Sri. T. S. Govindan
Driver Grade II (L. V.)-2	: Sri. Gopalakrishnan
	Sri: Vikram Nair
Pump Operator-7	: Sri. V. B. Easaf
	Sri. K. K. Francis
	Sri. T. P. Jose Mathews
	Sri. A. Narayanan
	Sri. C. R. Cochu
	Sri. M. V. Parameswaran
	Sri. E. Parameswaran Nair
	Sri. C. Kumaran Nair
Cleaner-1	: Sri. K. M. Haneefa
Peon-8	: Sri. K. C. Krishnan
	Sri. K. P. Kumaran
	Sri. V. L. Antony
	Sri. N. Purantharan
	Sri. Nesam
	Sri. V. A. Pareed
	Two posts vacant

#### **Administrative & Supporting staff**

Financial Assistant-1	: Sri. B. Sankar Naik
Section Officer-2	: Sri. N. Padmanabhan Nair
	Sri. K. Sreerangan

Office Superintendent-1	:	Sri. O. U. Chandran
Head Draftsman-1	:	Sri. K. N. Velayudhan Ezhuthassan (till 28-2-81) Smt. V. Savithri (from 28-2-81)
Assistant Senior Grade-4	:	Sri. K. Narayanan Namboothri Sri. K. A. Mohammed Smt. M. K. Shylaja Smt. C. V. Santha
Stenographer-1	:	Smt. K. M. Mary
Assistant Grade I-4	:	Sri. V. A. Achuthen Smt. S. Valsala Smt. A. T. Gracy Smt. A. K. Lyla
Draftsmen Grade I-1	:	Sri. T. J. Antony
Typist Grade I-2	:	Smt. K. B. Girija Smt. M. A. Bhargavi
Assistant Grade II-5	:	Sri. N. Parameswaran Nair Smt. E. N. Savithri Three posts upgraded as Ist Gr. Asst.
Typist Grade II-1	:	Sri. M. K. Muraleedhara Karnavar
Driver Grade II-1	:	Sri. P. K. Sasi
Tracer-2	:	Vacant
Blue Printer-cum- terio Operator	:	Sri. T. T. Ousephunny
Peon-2	:	Sri. M. K. Gangadharan Sri. K. C. Krishnan

## Appendix IV

### LIST OF STEFF IN THE VARIOUS CAMPUSES

#### COLLEGE OF AGRICULTURE, VELLAYANI

Dean	:	Dr. N. Sadanandan
<b>Department of Agronomy</b>		
<b>Scientists</b>		
Professor -1	:	Dr. C. Sreedharan
Associate Professor -4	:	Sri. K. P. Madhavan Nair Sri. V. Ramachandran Nair Sri. P. Chandrasekharan Sri. G. Raghavan Pillai
Asst. Professor -4	:	Sri. V. Muralidharan Nair Sri. N. Purushothaman Nair Two posts vacant
Jr. Asst. Professor-3	:	Smt. Annamma George Smt. S. Chandini Sri. N. Purushothaman Nair
<b>Supporting staff</b>		
Sr. Grade Farm Asst -3	:	Sri. K. Cheilappan Sri. L. Devy Smt. J. T. Jasmine
Farm Asst. Grade I -2	:	Smt. Radhamma Thankachy Sri. H. Rachel
Typist Grade I -1	:	Smt. S. Radhamma
Laboratory Asst. Grade I-1	:	Sri. J. Dasayyan Nadar
Grade II -1	:	Sri. Augustine Nadar
Laboratory Attender -3	:	Sri. C. Thankappan Assary Sri. P. M. Sivadasan Sri. N. Dasayyan
Peen Grade I -1	:	Sri. K. Sreekantan Nair
Grade II -1	:	Sri. M. Moniyan
<b>Department of Agricultural Botany</b>		
<b>Scientists</b>		
Professor -1	:	Dr. (Mrs.) Mary K. George
Assoc. Professor -4	:	Sri. A. T. Abraham Sri. N. Gopinathan Nair Dr. S. T. Mercy Sri. K. Gopakumar

- Asst. Professor -3 : Smt. N. Kamalam  
Smt. D. Chandramony  
One post vacant
- Jr. Asst. Professor -3 : Smt. J. Sreekumari Amma  
(till 4-6-80)  
Smt. P. Manju  
(from 5-6-80)  
Sri. S. G. Sreekumar,  
(from 9-7-80 to 24-9-80)  
Smt. J. Sreekumari  
(10-7-80 to 24-9-80)  
Smt. Radha Devi  
(from 24-9-80)  
Sri. P. Rajendran  
(till 7-6-80)  
Smt. Suma Bai D. I.  
(from 7-6-80)

**Supporting Staff**

- Technical Assistant -1 : Sri. V. Sivadasan
- Agricultural Demonstrator -1 : Smt. Sachee Devi
- Lab. Asst. Grade II -1 : Sri. V. K. Sadasivan Pillai  
(till 18-9-80)  
Sri. Bhanu  
(from 19-9-80)
- Lab Attender -2 : Sri N. Dasayyan  
Sri. N. Nanukuttan Nair
- Peon Grade -1 : Sri. C. Kesavan  
Sri. P. Sadasivan Pillai
- Scavanger-1 : Smt. J. Chellamma

**Department of Agricultural Chemistry**

**Scientists**

- Professor-1 : Dr. R. S. Aiyer
- Associate Professor-2 : Sri. Thomas Varghese  
Dr. (Mrs.) P. Padmaja
- Assistant Professor-4 : Smt. Alice Abraham  
Sri. K. Babukutty  
Sri. P. A. Korah  
Sri. C. Sundaresan Nair
- Jr. Asst. Professor-3 : Sri. P. Rajendran  
Kum. Suman George  
Kum. Prabha Kumari

**Supporting Staff**

- Assistant Chemist-2 : Smt. Sushema  
Smt. Vasundhara Bai
- Bacteriology Assistant-1 : Sri. K. C. John
- Technical Assistant-1 : Sri. Muralidharan Nair



## **Department of Entomology**

### **Scientists**

- Professor-1 : Dr. N. Mohondas  
Associate Professor-6 : Dr. John Kurian  
Sri. S. P. Christudas  
Dr. A. Visalakshi  
Dr. Abraham Jacob  
Dr. D. Dale  
One post vacant  
Assistant Professor-7 : Sri. K. K. Ravindran Nair  
Sri. P. A. Rajan Assari  
Sri. K. Sasidharan Pillai  
Sri. George Koshy  
Dr. P. B. Gopinath  
Smt. K. Saradamma  
Smt. Susamma Mathai  
Jr. Assistant Professor-5 : Smt. G. Sobhana  
Smt. M. S. Sheela  
Smt. Ambika Devi  
Smt. Hobsey Bai  
Smt. Sudharma K.

### **Supporting Staff**

- Technical Assistant-1 : Smt. A. Lakshmikutty  
Demonstrator (G. T. A.)-1 : Sri. L. Venkitachala Sarma  
Laboratory Asst. Grade II : Sri. M. Krishnan Nair  
Laboratory Asst. Grade III-4 : Sri. Sreedharan Nair  
Sri. P. Thankayan  
Smt. B. Sakunthala  
Smt. K. Sakunthala  
Farm Assistant Grade I-2 : Smt. A. Belsy  
Smt. H. Rachel  
Assistant Grade I-1 : Sri. T. Sasikumar  
Peon-1 : Sri. P. Sreedharan Pillai

## **Department of Agricultural Extension**

### **Scientists**

- Professor-1 : Sri. A. G. G. Menon  
Associate Professor-4 : Dr. A. M. Thampi  
Dr. G. T. Nair  
Dr. L. Prema  
One post vacant  
Assistant Professor-4 : Sri. M. M. Hussain  
Dr. C. Bhaskaran  
Smt. N. K. Vimala Kumari  
One post vacant

Jr. Assistant Professor-4 ; Sri. S. Muralidhara Prasad  
(till 27-8-80)  
Sri. Ranjan S. Karippai  
(from 4-9-80)  
Sri. R. Prakash  
Dr. C. Bhaskaran  
(till 12-11-80)  
Sri. V. B. Padmanabhan  
(from 15-11-80)  
Smt. V. Usha  
Smt. Mary Ukkuru

**Supporting Staff**

Office Superintendent-1 : Sri. N. Somarajan  
Lab. Assistant Grade I-1 ; Sri. V. Kesavankutty  
Technician Grade I-1 : Sri. V. Sukumaran  
Artist-2 : Sri. P. S. Kesavan Namboodiri  
Sri. P. Ganapathy  
Photographer-1 : Sri. M. S. Kuriakose  
Farm Assistant Grade I-1 : Sri. Gopinathan Nair  
Typist Grade I-1 : Smt. K. Vimala  
Driver-1 : Sri. K. Gopinathan Nair  
Duplicator Operator-1 : Sri. S. Dickson  
Peon-1 : Sri. N. Thompson Nadar  
Watcher-1 : Sri. G. Sreedharan Nair  
Sweeper-cum-Scavenger-1 : Smt. B. Rugmini Amma

**Department of Agricultural Economics**

**Scientists**

Associate Professor-1 : Sri. K. S. Karayalar  
Assistant Professor-2 : Sri. B. Venugopal  
: Sri. E. R. Narayanan Nair  
Jr. Assistant Professor-2 : Sri. E. K. Thomas  
Vacant

**Supporting Staff**

Peon-1 : Sri. L. James

**Department of Agricultural Statistics**

**Scientists**

Professor-1 : Sri. E. J. Thomas  
Associate Professor-2 : Vacant  
Assistant Professor-5 : Sri. M. P. Abdurazak  
Sri. Yageen Thomas  
Three posts vacant  
Jr. Assistant Professor-1 ; Smt. T. Leela

**Supporting Staff**

Technical Assistant-4	:	Sri. T. C. Mukundan Smt. P. Saraswthy Smt. V. M. Sarada One post vacant
Assistant Grade I-1	:	Kum. B. C. Girija Devi
Typist Grade I-2	:	Kum. S. Sudha Devi Sri. S. Vijayarangan
Attender-1	:	Sri. S. Ravindran Nair
Peon-2	:	Sri. S. Paul One post vacant

**Department of Agricultural Engineering****Scientists**

Associate Professor-2	:	Sri. P. Jacob John (till 20-7-80) Sri. Jippu Jacob
Jr. Assistant Professor-1	:	Vaccant

**Supporting Staff**

Technician Grade I-1	:	Sri. N. Sasidhara Panickar
Technician Grade II-3	:	Sri. T. Sreedharan Sri. D. Sreekantan Nair One post vacant
Lab. Assistant Grade II-1	:	Sri. V. Purushothaman
Oil Engine Driver Gr. I-1	:	Sri. M. Abdul Muthalif
Lab. Assistant Grade III-1	:	Sri. G. Encse (till 6-3-81)
Assistant Grade II	:	Sri. Abdul Samath (till 5-6-80)
Peon-1	:	Sri. A. Johnson

**Department of Plant Breeding****Scientists**

Professor-1	:	Dr. V. Gopinathan Nair
Associate Professor-3	:	Sri. A. Padmanabhan Thampi Sri. K. Gopakumar Sri. R. Gopimony
Assistant Professor-2	:	Dr. P. Manikantan Nair One post vacant
Jr. Assistant Professor-1	:	Kum. D. S. Radha Devi (till 24-9-80) Smt. J. Sreekumari Amma (from 24-9-80)

**Supporting Staff****Technical Staff**

From Assistant Grade II-1	:	Vacant
Assistant Grade II-1	:	Sri. Abdul Samath (On working arrangement)
Lab Assistant Grade III-1	:	Sri. S. Haneefa
Peon-1	:	Sri. K. Narayana Das

**Department of Plant Pathology  
Scientists**

- Professor-1 : Dr. M. Chandrasekharan Nair  
(The post was vacant till 11-11-80)  
Additional charge held by  
Dr. M. C. Nair)
- Associate Professor-4 : Dr. M. Chandrasekharan Nair  
(till 10-11-80)  
Dr. S. Balakrishnan (from 11-11-80)  
Dr. James Mathew  
Dr. Sasikumaran Nair  
One post shifted to Vellanikkara
- Assistant Professor-4 : Sri. M. Abraham  
Sri G. Padmakumari  
Smt. S. Bhavani Devi  
Dr. B. Rajagopal
- Jr. Assistant Professor-6 : Sri. M. V. Rajendran Pillai  
Miss. K. K. Sulochana (till 19-9-80)  
Miss. P. Santhakumari  
Sri. Koshi Abraham (till 4-8-80)  
Sri A. V. Mathew (from 5-8-80)  
Sri. P. Sivaprasad (till 12-9-80)  
Kum. A. Naseema (from 3-10-80)  
Smt. M. Subharban (till 30-3-81)

**Supporting Staff**

- Farm Assistant Grade (Senior)-3 : Smt. K. Rasammal  
Smt. L. Indira (till 30-9-80)  
Smt. S. Sarojini (from 1-10-80)  
Smt. K. Panky
- Farm Assistant Grade I-1 : Sri. Machavan Nair (till 12-1-81)
- Lab Keeper-1 : Sri. A. Aloysious
- Mali-Field Assistant-1 : Sri. V. Sreedharan Nair
- Attender-2 : Sri. K. Joseph  
Sri. S. Kuttappan Nair
- Peon-2 : Sri. Appukuttan Nair  
Sri. G. Thankappan Nair

**Department of Horticulture  
Scientists**

- Professor-1 : Sri. P. Sethumadhavan
- Associate Professor-1 : Sri. P. D. Vijayagopal
- Assistant Professor-2 : Sri. B. K. Jayachandran  
One post shifted
- Jr. Assistant Professor-2 : Sri. B. R. Reghunath  
Sri. M. Abdul Vahab

**Supporting Staff**

Farm Assistant Grade Senior-2	:	Sri. V. Chakrapani Smt. K. Padmakshy
Laboratory Assistant Grade II-2	:	Sri. P. Alexander Sri. A. Prabhakaran
Gardener-1	:	Sri. G. Parameswaran Nair
Farm Worker-1	:	Smt. K. Kamalakshy
Peon-2	:	Vacant

**Department of Animal Husbandry  
Scientists**

Associate Professor-1	:	Dr. Skariah Oommen
Assistant Professor-1	:	Dr. E. T. Jacob

**Supporting Staff**

Farm Supervisor-1	:	Sri. R. Narayanan Nair
Farm Assistant-3	:	Sri. Christudhanam Sri. R. Ramachandran Nair Sri. G. Venu
Peon-1	:	Sri. K. Parameswaran Nadar

**Department of Physical Education**

Jr. Asst. Professor-2	:	Sri. S. P. Pillai Smt. A. C. Marykutty
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**Administrative staff of the College of Agriculture**

Administrative Officer-1	:	Sri. K. G. Balakrishna Pillai
Section Officer-6	:	Sri. M. Krishnan Nair Sri. M. Nakulan Sri. A. P. Lawrence Sri. M. K. Ramarajulu Sri. J. I. Wilson Smt. R. Kamala Bai Sri. S. Ponnayyan Smt. S. Sreedhari Amma
Senior Office Superintendent-3	:	Smt. L. Lalitha Smt. D. Hymavathy Sri. L. Radhakrishnan Potti
Senior Grade Assistant-7	:	Sri. P. R. Sasidharan Pillai Sri. K. Ravikumar Smt. V. M. Lalitha Kumari Smt. M. N. Sreedevi Sri. L. Wilson Sri. S. Krishnan Nair Smt. J. R. Fathima Malar

- Asstant Grade I -9 : Sri. A. Abdul Karim  
Sri. Abdul Samad  
Sri. N. Valsan  
Smt. B. C. Girija Devi  
Smt. S. G. Kumari Girija  
Smt. Marykutty Samuel  
Sri. Purushothaman Nampiathiri  
Sri. E. Shamsuddin  
Sri. S. Reghupathy Chettiar
- Assistant Grade II -7 : Sri. C. N. Radhakrishnan  
Sri. K. Viswanathan Aasary  
Sri. N. K. Mohankumar  
Smt. C. Suchetha  
Smt. P. Jameela  
Smt. J. Remadevi Amma  
Sri. K. Balachandran Nair
- Typist Senior Grade-3 : Sri. A. William  
Smt. J. A. Emiammal  
Smt. S. Valsala Devi
- Typist Grade I -4 : Sri. C. Rajendran Nair  
Smt. S. Sudha Devi  
Smt. K. Vimala  
Smt. S. Radhamma
- Office Superintendent  
(FC & D)-3 : Sri. M. R. Ravindran  
Sri. S. Vijayarangan  
Smt. V. Subaida Beevi

#### College of Horticulture, Vellanikkara

- Associate Dean : Dr. P. C. S. Nair  
(till 9-3-'81)  
Dr. P. K. Gopalakrishnan  
held additional charge from 9-3-81.

#### Department of Pomology and Floriculture

##### Scientists

- Professor-1 : Dr. M. Aravindakshan
- Assistant Professor-1 : Smt. P. K. Valsalakumari
- Junior Asst. Professor-2 : Smt. T. Radha  
Sri. N. K. Paramaswaran  
(till 8-9-'80)  
Smt. Valsamma Mathew  
(from 26-9-'80)

**Supporting Staff**

- Farm Assistant (Senior Grade)-2 : Smt. P. K. Vijayalakshmi  
Smt. S. Thanka Bai  
Laboratory Attender-1 : Sri. K. R. Prabhakaran  
Gardener-1 : Sri. Antony

**Department of Processing Technology****Scientists**

- Professor-1 : Sri. P. Sethumadhavan  
(till 31-5-'80)  
Sri. V. K. Damodaran  
(from 1-5-'80)  
Assistant Professor-1 : Smt. K. A. Girija  
Junior Assistant Professor-3 : Smt. V. Indira  
Sri. N. Saifudeen  
Valsamma Mathew  
(till 24-7-'80)  
Sri. P. Jacob John  
(from 24-7-'80)

**Supporting Staff**

- Processing Technology Asst.-1 : Sri. K. Kumaran  
Attender-1 : Sri. K. G. Krishnan

**Department of Olericulture****Scientists**

- Professor-1 : Dr. P. K. Gopalakrishnan  
Special Officer-1 : Dr. K. V. Peter  
(Vegetable Breeding)  
Junior Assistant Professor-2 : Sri. S. M. Akbar  
Sri. K. V. Subramaniam

**Supporting Staff**

- Farm Assistant Special  
Grade I -1 : Smt. K. V. Eliamma  
,, Grade I-1 : Sri. Ajayakumar  
,, Grade III-1 : Smt. M. K. Chandramathy  
Laboratory Attender-1 : Vacant  
Farm Supervisor-1 : Sri. K. Chellappan

**Department of Plantation Crops & Spices****Scientists**

- Professor-1 : Dr. N. Mohanakumaran  
Asst. Professor-1 : Smt. P. A. Nazeem  
(from 7-11-'80)

Jr. Asst. Professor-2 : Sri. R. Keshavachandran  
(till 19-9-80)  
Smt. T. Premaletha  
(from 21-1-80)  
Smt. P. A. Nazeem  
(till 7-11-80)  
Smt. Rema Menon  
(from 11-7-80)

**Scheme for starting P. G. Diploma in Natural Rubber Production**

Associate Professor-1 : Dr. T. V. Viswanathan  
Jr. Asst. Professor-1 : Sri. Joseph Philip  
(till 17-11-80)  
Smt. P. A. Valsala  
(from 2-12-80)

**Supporting Staff**

Farm Assistant-1 : Sri. James V.  
Laboratory Attender-1 : Sri. C. A. Divakaran

**Department of Agricultural Botany**

**Scientists**

Professor-1 : Dr. K. M. Narayanan Namboothiri  
Asst. Professor-4 : Sri. Luckins C Babu  
Smt. V. K. Mallika,  
Smt. Achamma Oommen  
Sri. T. R. Gopalakrishnan  
Jr. Asst. Professor-2 : Sri. Mathew Jacob  
(till 31-10-80)  
Smt. Prasanna Kumari K. T.  
(from 22-11-80)  
One post vacant

**Supporting Staff**

Farm Asst. Grade II-1 : Sri. V. C. M. Das  
Laboratory Attender-1 : Sri. P. Unnikrishnan  
Assistant Grade I-1 : Sri. P. U. Kesavan  
Typist Grade II-1 : Smt. P. Lalitha (till 13-9-80)  
Sri. G. Hareendran  
(from 8-10-80 to 17-3-'81)  
Peon-2 : Vacant

**Department of Agricultural Engineering**

**Scientists**

Professor-1 : Dr. Jose Samuel  
Special Officer-1 : Sri. T. P. George  
Associate Professor-2 : Sri. K. John Thomas  
Smt. A. N. Rema Devi



Assistant Professor-1 : Vacant  
 Jr. Asst. Professor-2 : Smt. M. Sivaswami  
 Sri. Vijayan Raja  
 Research Associate-2 : Smt. A. V. Saramma  
 One post vacant

**Supporting staff**

Driver Grade II-1 : Sri. Raghunathan Nair  
 Technician Grade III-3 : Sri. P. M. Ramachandran  
 Sri. T. R. Viswambharan  
 Sri R. V. Johny  
 Workshop Attender-1 : Vacant

**Department of Agricultural Statistics**

**Scientists**

Associate Professor-2 : Dr. K. C. George  
 Sri. P. V. Prabhakaran  
 Asst. Professor-1 : Sri. V. K. Gopinathan Unnithan

**Department of Agronomy**

**Scientists**

Associate Professor-1 : Dr. R. Vikraman Nair  
 Asst. Professor-1 : Sri. M. Abdul Salam

**Supporting staff**

Farm Assistant Grade II : Smt. N. J. Eliamma  
 Laboratory Asst. Grade III-1 : Sri. N. Prakashan

**Department of Agrometeorology**

**Scientists**

Professor-1 : Dr. P. Balakrishna Pillai  
 (from 16-3-81)  
 Associate Professor-1 : Dr. P. Balakrishna Pillai  
 (till 15-3-'81)  
 The post was abolished subsequent  
 to the creation of the post of  
 Professor  
 Assistant Professor-1 : Dr. G. S. L. H. V. Prasad Rao  
 (from 1-12-'80)

**Department of Soil Science & Agricultural Chemistry**

**Scientists**

Associate Professor-2 : Dr. A. I. Jose  
 (Soil Science & Agrl. Chemistry) (till 29-1-81)  
 Dr. Anil Kumar Sharda  
 (from 2-12-80)  
 Asst. Professor-3 : Smt. K. C. Marykutty  
 (till 8-9-'80)  
 Sri. P. C. Antony (from 18-11-10)  
 Smt. K. A. Mariam  
 One post vacant

### **Coconut Root (wilt) Disease Project**

- Professor-1 : Vacant  
Dr. A. I. Jose, in charge from 30-1-81.  
Associate Professor-1 : Dr. A. I. Jose (from 30-1-81)  
Jr. Asst. Professor-2 : Sri. N. Saifudeen  
One post vacant

### **AICARP**

- Asst. Professor-1 : Smt. G. Santhakumari  
(Agrl. Chemistry)  
Jr. Asst. Professor-1 : Sri. C. S. Gopi  
(Agrl. Chemistry)

### **Supporting staff**

- Laboratory Assistant Grade I-1 : Sri. M. Thankappan Nair  
Laboratory Attender-1 : Sri. E. K. Chathu

### **Department of Agricultural Entomology**

#### **Scientists**

- Professor-1 : Dr. C. C. Abraham (till 13-3-61)  
(Entomology)  
Professor of Nematology-1 : Dr. T. S. Venkitesan, in charge  
Coconut Root (wilt) Disease from 29-1-81  
Associate Professor-1 : Dr. V. Mammen  
(Entomology)  
(Nematology-1 : Dr. T. S. Venkitesan  
Asst. Professor-3 : Sri. G. Madhavan Nair  
(Entomology) : Dr. P. J. Joy (till 17-3-81)  
Smt. T. Nalinakumari  
(Nematology) KADP-1 : Sri. Arthur Jacob  
Coconut Root Wilt-1 : Vacant  
Jr. Asst. Professor-1 : Smt. Susannamma Kurian  
(Nematology/Coconut Root Wilt)

#### **Supporting staff**

- Laboratory Assistant-1 : Sri. C. R. Balakrishnan  
One post vacant

### **Department of Plant Pathology**

- Professor  
(Plant Pathology/Root (Wilt)-1 : Dr. Abi Cheeran (from 31-1-81  
Scheme : Dr. K. M. Rajan (from 19-3-81)  
Associate Professor-2 : Sri. P. C. Jose (from 21-2-81  
Dr. C. K. Peethambaran  
(from 7-11-80)  
Asst. Professor-1 : Sri. A. Sukumara Varma

Jr. Asst. Professor  
KADP-2 : Smt. Sally K. Mathew (till 11-9-80)  
Smt. T. N. Vilasini (from 19-9-80)  
Pepper Research Scheme-1 : K. M. Thomas (till 4-9-80)

**Supporting staff**

Assistant Grade I-1 : Sri. K. P. Rajan  
(Pepper Research Scheme)  
Stenographer Grade II -1 : Smt. M. L. Sosannam  
Root (Wilt) Scheme (from 7-3-81)  
Farm Asst. Grade I -1 : Sri. T. C. Sidharthan  
Lab Asst. Grade II -1 : Sri. Nandakumaran  
Peon (Pepper Research  
Scheme)-1 : Sri. P. K. Bhaskaran  
Watchmen-1 : Vacant

**Department of Agricultural Extension**

**Scientists**

Assistant Professor-1 : Sri. K. P. R. Nair

**Department of Physical Education**

Jr. Asst. Professor-2 : Sri. K. N. K. Nair  
Smt. Susy V. John

**All India Co-ordinated Project for the improvement of tuber  
crops (Other than potato)**

**Scientists**

Asst. Professor-1 : Sri. P. K. Asokan  
(Agronomy)  
Jr. Asst. Professor-1 : Sri. L. Sudhakara

**Kerala Agricultural Development Project**

**Scientists**

Professor of Horticulture  
(Coconut)-1 : Dr. P. K. Gopalakrishnan  
(Cocoa)-1 : Dr. N. Krishnan Nair  
(Cashew)-1 : Sri. K. K. Vidyadharan  
(Pepper)-1 : Dr. N. Mohanakumaran till (16-3-81)  
Dr. Abi Cheeran (from 19-3-81)

**Associate Professor**

(Instrumentation)-1 : Sri. K. Madhavan Nair  
(Radio Tracer)-1 : Dr. P. Abdul Wahid  
(Safety Officer)-1 : Smt. N. V. Kamalam

**Assistant Professor**

(Horticulture)-1 : Sri. P. P. Balasubramanian  
(from 22-8-80)

**Assistant Professor**

(Nematology) : Dr. P. J. Joy (till 13-11-80)

Assistant Professor (Biochemistry)-1	: Sri. A. Augustine
Assistant Professor (Soil Science)-1	: Dr. V. K. Venugopal
Junior Asst. Professor (Virology)-1	: Smt. Sally K. Mathew (till 11-9-80) Smt. T. N. Vilasini (from 19-9-80)
Junior Asst. Professor (Plant pathology)-1	: Sri. S. Ravi
<b>Supporting staff</b>	
Farm Assistant Grade I-2	: Sri. K. V. Natarajan Sri. M. Revi Kumar
„ Grade II-1	: Sri. P. K. Haridasan
Laboratory Attender-2	: Sri. P. V. Kumaran (till 15-11-80) Sri. V. Ramachandran Nair (till 8-10-81)
Stenographer Grade I-1	: Sri. A. Ramachandran Unnithan
Assistant Grade II-2	: Sri. S. Viswakumaran Nair (till 13-5-80) Sri. M. Aravindakshan (provisional) (from 24-11-80 to 31-3-80) Sri. K. P. Ramesan
Driver Grade II-6	: Sri. K. V. Kochappen Sri. A. V. Kunhikrishnan Sri. K. A. Jabbar (till 3-1-81) Sri. M. Unnankutty (from 17-4-80 to 22-4-80) Sri. M. S. Kunju (from 22-4-80 to 10-12-10) Sri. P. V. Sudhakaran (from 10-12-80) Sri. K. O. John Stephen (on working arrangement) Sri. K. V. Koya (from 10-6-80) Sri. C. N. Soman (from 5-9-80)
<b>Administrative staff of the College of Horticulture</b>	
Administrative Assistant-1	: Sri. K. Kuttappan Nair
Section Officer-3	: Sri. K. A. Appuchettiar „ K. K. Parameswaran „ V. Venugopalan
Senior Office Superintendent (FCD)-1	: Smt. T. Lakshmikutty Amma
Senior Grade Assistant-3	: „ E. K. Bharathy „ K. K. Gauthamy Sri. K. N. Pushpangathan

Assistant Grade I-2	:	„ P. M. Cherukutty „ Rajasekharan
Assistant Grade II-4	:	„ K. F. Mathew Smt. Girija „ Mohnakumari Sri. Haridas
Senior Grade Typist-3	:	Smt. P. V. Brizitha „ Balamany „ K. N. Santhakumari
Senior Grade Farm Assistant -3	:	„ P. K. Vijayalakshi Sri. Sadasivan Chettiär Smt. K. V. Eliamma
Lab. Assistant Grade I-2	:	Sri. M. Thankappan Nair Sri. M. C. Chandran
Higher Grade Peon-1	:	„ M. N. Sivaraman
Clerical Assistant-1	:	„ Bhaskaran
Lab. Assistant Grade III-8	:	„ V. Nandakumaran „ C. R. Balakrishnan „ K. R. Prabhakaran „ K. G. Krishnan „ E. K. Chathu Smt. K. Thankamani Sri. C. A. Divakaran Smt. K. Padmavathy
Watchman-3	:	Sri. R. Gopalan Nair Sri. K. P. Ummer Sri. P. I. Gulmuhamed
Peon-2	:	Sri. R. B. Ibrahim Sri. K. V. Ramachandran
Reference Assistant-2	:	Sri. M. C. Lalitha Sri. Abdul Razak C.
Library Attender-1	:	Sri. P. Unnikrishnan
Grade II Farm Asst.-3	:	Sri. K. S. Thankappan Sri. V. James Sri. K. S. Ajayakumar
Driver Grade II (HV)-1	:	Sri. K. Prabhakaran Nair
Driver Grade II (LV)-2	:	Sri. K. V. Koya Sri. M. K. Rajendran Nair
Cleaner-cum-Conductor-1	:	Sri. K. Kunhunni Nair
<b>College of Veterinary &amp; Animal Sciences, Mannuthy</b>		
Dean	:	Dr. M. Krishnan Nair
<b>Department</b>		
<b>Anatomy</b>		
Professor-1	:	Dr. K. Radhakrishnan

Assoc. Professor-2	: Dr. P. A. Oommen Dr. Lucy Paily
Asst. Professor-1	: Dr. K. R. Harshan
Jr. Asst. Professor-1	: Dr. C. K. Sreedharan Unni
<b>Animal Management</b>	
Professor-1	: Dr. T. G. Rajagopalan
Assoc. Professor-1	: Dr. Kurian Thomas
Asst. Professor-1	: Dr. K. S. Sebastian
Jr. Asst. Professor-1	: Dr. Francis Xavier
<b>Animal Reproduction</b>	
Professor-1	: Dr. C. K. Surendra Varma Raja
Assoc. Professor-3	: Dr. C. P. Neelakanta Iyer Dr. K. Prabhakaran Nair Dr. E. Mathai
Asst. Professor-2	: Dr. E. Madhavan Dr. T. Sreekumaran
Jr. Asst. Professor-1	: Dr. K. V. Athman
<b>Breeding &amp; Genetics</b>	
Professor-1	: Dr. G. Mukundan
Assoc. Professor-2	: Dr. C. A. Rajagopala Raja Dr. Sosamma Iype
Asst. Professor-1	: Dr. K. V. Raghunandan
Jr. Asst. Professor-1	: Dr. K. C. Raghavan
<b>Clinical Medicine (Therapeutics)</b>	
Professor-1	: Dr. N. M. Aleyas
Asst. Professor-1	: Dr. V. S. Balakrishnan
Jr. Asst. Professor-2	: Dr. K. M. Jayakumar Dr. P. C. Alex
<b>Dairy Science</b>	
Professor-1	: Dr. M. Subramanyam
Assoc. Professor-1	: Dr. K. Pavithran
Asst. Professor-1	: Dr. M.V. Sukumaran (on deputation) Dr. U. T. Francis Dr. V. Prasad
Jr. Asst. Professor-1	: Dr. M. Mukundan
<b>Extension</b>	
Professor-1	: Dr. G. R. Nair
Asso. Professor-1	: Dr. T. Prabhakaran
Asst. Professor-1	: Dr. V. Raju (Supdt.)
Jr. Asst. Professor-2	: Dr. C.V. Andrews (Poultry Section) Dr. M. R. Subhadra (on leave)
<b>Microbiology</b>	
Professor-1	: Dr. P. K. Abdulla
Assoc. Professor-1	: Dr. S. Sulochana

Asst. Professor-2	: Dr. V. Jayaprakash Dr. Q. Madhusoodanan Pillai
<b>Nutrition</b>	
Professor-1	: Dr. E. Sivaraman
Assoc. Professor-2	: Dr. C. T. Thomas Dr. P. A. Devassia
Asst. Professor-2	: Dr. George Mathan Dr. T. V. Viswnathan
Asst. Professor (Chemistry)-1	: Sri. M. Nandakumaran
<b>Parasitology</b>	
Professor-1	: Dr. R. K. Sundaram (till 15-11-80)
Assoc. Professor-4	: Dr. K. Rajamohan Dr. K. Chandrasekaran Dr. V. Sathianesan Dr. K. Madhavan Pillai
Asst. Professor-3	: Dr. C. George Varghese Dr. C. Pythal Dr. H. Subramaniam
<b>Pathology</b>	
Professor-1	: Dr. A. Rajan
Assoc. Professor-2	: Dr. K. M. Ramachandran Dr. K. I. Maryamma
Asst. Professor-1	: Dr. K. V. Valsala
Jr. Asst. Professor-3	: Dr. C. R. Lalithakunjamma Dr. C. B. Manomohan Dr. N. Vijayan
<b>Pharmacology</b>	
Professor-1	: Dr. M. K. Rajagopalan
Assoc. Professor-2	: Dr. Jacob V. Cheeran Dr. Zacharias Cherian
Asst. Professor-2	: Dr. P. Marykutty Dr. N. Gopakumar
Asst. Professor (Chemistry)-1	: Sri. V. R. Raghunandan
<b>Physiology</b>	
Professor-1	: Dr. G. Nirmalan
Asso. Professor-2	: „ G. Venugopal „ M. G. Ramakrishna Pillai
Asst. Professor-3	: „ K. P. Surendranathan „ E. T. Jacob „ P. T. Philomina
Asst. Professor (Chemistry)-1	: Sri. P. K. Ismail
<b>Poultry Science</b>	
Professor-1	: Dr. A. Ramakrishnan

Assoc. Professor-1	:	.. R. Ramakrishnan
Asst. Professor-1	:	.. R. Sabarinalhan Nair (on deputation)
Jr. Asst. Professor-2	:	.. V. K. Elizabeth .. K. Narayanankutty
<b>Preventive Medicine</b>		
Professor-1	:	.. E. P. Paily
Asso. Professor	:	.. P. T. Georgekutty
Asst. Professor-2	:	.. (Mrs.) K. Baby .. K. Venugopal
Jr. Asst. Professor-1	:	.. M. R. Saseendranathan
<b>Surgery</b>		
Professor-1	:	.. P. O. George
Assoc. Professor-3	:	.. K. N. Muraleedharan Nayar (on deputation) Dr. A. M. Jalaluddin (on deputation) .. S. Revindran Nayar
Asst. Professor-1	:	.. C. Abraham Varkey
Jr. Asst. Professor-2	:	.. T. Sarada Amma .. K. Rajankutty
<b>Veterinary Public Health</b>		
Professor 1	:	Dr. R. Padmanabha Iyer (on deputation)
Assoc. Professor 2	:	Dr. M. Soman Dr. P. Prabhakaran
Asst. Professor 2	:	Dr. J. Abraham Dr. E. Nanu
Jr. Asst. Professor 2	:	Dr. M. T. Jose Dr. P. Kuttinarayanan
<b>Statistics</b>		
Professor 1	:	Dr. P. U. Surendran
Asst. Professor 1	:	Sri. R. Balakrishnan Asan
Jr. Asst. Professor 1	:	Sri. K. L. Sunny
<b>Physical Education</b>		
Jr. Asst. Professor-2	:	Sri. O. K. Paul Smt. Molly Cherian
<b>College of Fisheries, Ernakulam</b>		
Dean	:	Dr. M. J. Sebastian
<b>Scientists</b>		
<b>Department of Aquaculture</b>		
Professor-1	:	Dr. D. M. Thampy
Asst. Professor-1	:	Sri. M. G. Jayaram
Jr. Asst. Professor -1	:	Sri. C. G. Rajendran
<b>Department of Fishery Biology</b>		
Asst. Professor-1	:	Dr. P. Rabindranath (from 16-2-80)



**Department of Fish Processing Technology**

Assoc. professor -1 : Sri. D. Damodaran Namboodiri

**Department of Fishing Hydrography**

Assoc. Professor -1 : „ K. K. Varma

**Department of Fishing Technology**

Assoc. Professor -1 : Vacant

**Department of Fishing Engineering**

Assoc. Professor-1 : Sri. George Joseph Vincent

**Department of Management Studies**

Assoc. Professor-1 : „ T. M. Sankaran

Asst. Professor

(Zoology)-1 : Dr. (Mrs.) Shylaja Kumari  
(from 8-9-80)

(Biochemistry)-1 : Sri. P. M. Sheriff (from 10-11-80)

(F. Microbiology)-1 : Dr. M. C. George (from 9-12-80)

(Ichthyology)-1 : Dr. (Mrs.) S. D. Ritakumari  
(from 12-2-80)

(Algology)-1 : Dr. (Mrs.) Thresiamma Mathre  
(from 26-9-80)

(Brackish water fish farming)-1 : Dr. (Mrs.) K. Jayasree

(Fish Breeding)-1 : Sri. Y. Basavaraju (29-9-80)

Jr. Asst. Professor

(Genetics)-1 : Smt. Elizabeth Joseph

(Meteorology)-1 : Sri. N. N. Raman

(Commerce)-1 : „ Philip Sabu

(F. Economics)-1 : „ D. Rajasenan

**Supporting staff**

Administrative Asst. Grade I-1 : Sri. V. Sreenivasan

**INSTITUTE OF AGRICULTURAL TECHNOLOGY, TAVANUR**

Director : Sri. N. N. Ramankutty

**Scientists**

Asst. Professor

(Agrl. Engg)-2 : Sri. C. P. Mohammed  
„ Jobi V Paul

(Horticulture)-1 : „ S. Rajan

(Animal Husbandry)-2 : Dr. P. C. James  
Dr. M. R. Rajan (from 25-11-80)

(Agronomy)-1 : Sri. Philipose Joshua

Research Assistant-1 : „ A. P. Gopalakrishnan

Jr. Asst. Professor

(Animal Husbandry)-1 : Dr. C. M. Aravindakshan

(Farm)-1 : Sri. J. Arthur Jacob

(Plant Pathology)-1 : „ K. Anil Kumar

(Physical Education)-1 : „ E. Soman

(Agronomy)-3	: „ C. K. Prabhakaran Thampi „ P. Ahamed „ P. C. Balakrishnan
(Agrl. Chemistry)-1	: „ M. Subramanian Iyer
(Mech. Engg.)-1	: „ V. Ganesan
(Basic Science)-1	: Smt. V. P. Lakshmikutty
<b>Supporting Staff</b>	
Section Officer-1	: Smt. B. Sreedevi Amma
Office Superintendent-2	: Sri. J. Kochukunju (f.om 26-9-80) „ George Thomas
Stenographer-1	: „ C. Krishnankutty Nair
Asst. Senior Grade-4	: „ C. Arumughan „ K. Kunhoosa „ K. P. Kayamu „ C. Assainer
Asst. Grade I-4	: Smt. K. Leelamma „ K. U. Prabhavathi Sri. P. Unnikrishnan „ K. Mohammed Naha
Asst. Grade II-2	: Janardhanan „ V. Sivadasan
Typist Grade I-2	: Smt. K. Saraswathi Amma „ P. Radha
Typist Grade II-1	: „ P. Sarojini Ammal
Farm Asst. Grade I-3	: Sri. A. N. Parameswaran Smt. R. V. Balamani Sri. M. V. Raveendran
Farm Asst. Grade II-2	: „ C. Subramanian „ T. P. Ali
Farm Asst. (Vety.) Grade II-2	: Sri. P. Balakrishnan „ P. P. Narayana Panicker
Technician Grade II-5	: „ A. K. Padmanabhan Sri. V. P. Kannan „ C. S. Krishnan „ C. Velayudan „ T. P. Aboobaker
Technician Grade III-1	: „ R. T. Ramachandran
Laboratory Asst.-3	: „ P. Theyyuni Menon „ P. Krishnankutty Nair „ P. V. Kumaran
Librarian-1	: „ P. A. Parameswaran
Peon-Higher Grade-2	: Smt. K. Rohini Sri. P. Kunhikutta Menon

Peon-Higher Grade-1	:	„ T. Raghavan
Driver Grade II-3	:	„ T. Rappai „ N. V. Krishnan „ K. A. Jabbar
Watchman-Higher Grade-1	:	„ K. P. Chatha
Watchman-1	:	„ Beg Bahadoor
Gardener-Higher Grade-1	:	„ K. Mammikutty
Sweeper-1	:	Smt. K. V. Madhavi
Sweeper-cum-Attendant-1	:	Sri. V. Kuttimalu
Sweeper-cum-Marker-1	:	„ K. Kunhan
Scavenger-1	:	„ C. Kunhan
Pump Operator-1	:	„ M. R. Balakrishnan
Part time Sweeper-1	:	Smt. Ammukurupathiar

## RESEARCH STATIONS/SCHEMES/PROJECT

### Rice Research Station, Kayamkulam

#### Scientists

Assoc. Professor (Botany)-1	:	Sri. A. E. Sreedhara Kurup (Retired from service w. e. f. 28-2-81) Sri. M. G. Vasavan held additional charge from 1-3-81
Asst. Professor (Botany)-1	:	Vacant
(Plant Pathology)-1	:	Sri. M. G. Vasavan
(Agronomy)-1	:	Vacant
Jr. Asst. Professor-3	:	Sri. K. C. Aipe (till August 1980) Smt. P. Maya Devi Smt. R. S. Shahana (from December 80)

#### Supporting staff

Administrative Asst.-1	:	Smt. Mary Amma Eapen
Assistant Grade I -1	:	Smt. B. Thankamony
Asst. Grade II -1	:	Smt. N. Ponnama
Peon-1	:	Smt. Sosamma George
Farm Asst. Grade I -3	:	Sri. S. Krishnan Chettiar Smt. B. Radha Sri. M. Varghese
Field Supervisor-1	:	„ K. Janardhanan Pillai
Laboratory Attender-1	:	„ K. J. Joseph
Watchmen-2	:	„ R. Kunjukrishnan „ Sreedharan
Regular Mazdoor-2	:	„ T. Balakrishnan „ V. Achuthan

**Extension Education Centre (Pulses & Oilseeds), Rice Research Station Kayamkulam**

**Scientists**

Assoc. Professor (Agronomy)-1 : Sri. M. R. Chidananda Pillai  
(till 8-1-80)  
Smt. Lizy Behanan  
,, S. Shilaja (from 10-10-80)

**Supporting staff**

Farm Asst. Grade II -1 : Sri. E. K. Sukumaran  
(from 12-12-80)  
Driver-1 : Sri. E. K. Sukumara Pillai  
(from 1-10-80)

**Rice Research Station, Pattambi**

**Scientists**

Assoc. Professor : Sri. K. I. James  
,, P. K. Gangadhara Menon  
Dr. K. Karunakaran  
Sri. I. P. Sreedharan Nambiar  
(till 17-12-80)  
Sri. K. Karunakaran (till 30-3-81)  
Dr. K. P. Vasudevan Nair  
(from 30-3-81)  
Sri. P. K. Sathiarajan (till 21-2-81)  
,, V. P. Sukumara Dev  
(from 21-2-81)  
,, O. Abdul Rahiman Kunju

Asst. Professor : Sri. S. Janardhanan Pillai  
Dr. V. O. Kuruvila  
(from 11-10-10 to 27-11-80)  
Smt. Suma Kuruvila  
(from 28-11-80)  
Sri. A. Sreedharan (from 8-1-81)  
,, D. Alexander

Jr. Asst. Professor : Smt. P. Chandrika  
,, M. B. Jalajakumari  
Sri. M. Shahul Hameed  
(from 16-8-80)  
,, Johnkutty I (from 1-4-80  
28-2-81)  
,, M. Subramania Iyer  
(from 16-6-80 to 7-7-10)  
Smt. Marykutty Samuel  
(from 1-12-80 to 22-5-80)  
Sri. Baby P. Skariah

Smt. C. A. Mary (from 16-10-80)  
Sri. P. N. Mohan Das (from 9-10-80)  
,, S. Motilal Nahru  
Smt. K. E. Savithri (from 7-4-80)

**Supporting staff**

Farm Supervisor (Agri.)  
Grade I-1 : Sri. P. V. Narayanan  
Farm Supervisor (Agri.)  
Grade II-1 i Sri. M. N. Narayana Pillai  
(Vety.) Grade II-1 : Sri. K. Achuthan (from 9-12-80)  
Administrative Assistant-1 : Sri. N. Soman  
Section Officer : Sri. K. Sivanandan  
Sr. Office Superintendent-1 : Sri. K. Mammu  
Office Superintendent  
(FD & D)-1 : Sri. K. Muraleedharan  
Assistant Senior Grade-1 : Sri. K. Kunhoosa (till 23-9-80)  
Sri. P. M. Parameswaran  
Namboothiri  
Assistant Grade I : Smt. K. P. Kalliyani  
Sri. M. P. Balan  
Sri. K. Rangaswamy  
Assistant Grade II-3 : Sri. T. V. Raveendramohan  
Smt. T. Lakshmykutty  
Sri. A. Sreenivasa Raghavan  
Typist Grade II-2 : Sri. S. Raghavan  
Sri S. Ramani  
Peon-Higher Grade : Sri. K. Vasu  
Sri. A. Mammu  
Sri. K. P. Narayanan  
Sri. T. Ramen

**Rice Research Station, Moncompu**

**Scientists**

Assoc. Professor-4 : Sri. N. Rajappan Nair  
Dr. M. J. Thomas  
Sri. P. J. Ittyverah  
Dr. K. M. Rajan (till 18-3-81)  
Assistant Professor-5 : Sri. Madhusudanan Nair  
,, K. Balakrishna Pillai  
,, Babu M. Philip (from 9-2-81)  
,, G. Mathai (from 9-6-80)  
Smt. D. Chandramony (till 2-5-80)  
Smt. N. Rama Bai (from 30-3-81)  
Junior Statistician-1 : Smt. P. R. Krishna Kumari Amma

Jr. Asst. Professor-9 : Sri. Swarup John  
 (from 2-8-80 to 15-9-80)  
 Sri. V. Sreekumar (from 3-1-80)  
 „ B. Balakrishnan (from 20-8-80)  
 „ N. K. Sasidharan (from 21-8-80)  
 Smt. M. Meera Bai  
 (from 12-9-80)  
 Sri. Jim Thomas  
 (from 1-4-80 to 31-10-80)  
 Sri K. J. Joseph (from 23-12-80)  
 „ Babu George  
 „ Koshy Abraham  
 (from 11-8-80 to 15-9-80)  
 Sri. C. Gokulapalan (from 15-12-80)  
 „ C. Nandakumar (from 16-8-81)  
 Smt. N. Rema Bai (till 29-3-81)  
 Sri. P. S. John (from 18-8-80)  
 „ M. Girija Sankara Narayanan  
 Two posts shifted to College of  
 Fisheries.

**Supporting staff**

Farm Supervisor-1 : Sri. G. Ragavan Pillai  
 Farm Assistant Senior Grade-3 : „ K. Chellappan  
 „ C. O. Mathai (from 1-8-80)  
 „ C. N. Raghavan  
 Farm Assistant Grade I : „ A. K. Ayyappan Pillai  
 „ C. O. Mathai (till 31-7-80)  
 Field Supervisor-1 : „ V. Thankappan  
 Laboratory Asst. Gradel-1 : „ N. Sivadasan  
 Laboratory Attender : „ S. Chandrasekhara Pillai  
 Administrative Asst. Grade II-1 : „ K. I. Alex (till 30-9-80)  
 „ J. I. Walsalam (from 1-10-80)  
 Assistant Senior Grade : „ A. Kuriakose  
 Assistant Grade I-3 : Smt. V. P. Lakshmikutty  
 „ B. Sarasamma  
 „ D. Vijayamma (from 23-9-80)  
 Assistant Grade II-1 : Sri. M. Mohammed Bashir  
 (till 23-9-80)  
 Typist Grade I-1 : Smt. H. K. Khadeeja Beevi  
 Class IV-4 : Sri. N. Prakasan (till 21-1-81)  
 „ K. Chandrasekharan Nair  
 „ E. Kunju Pillai  
 „ P. K. Thankappan

- Driver-3 : .. M. D. Janardhanan (Boat)  
(from 9-1-81)  
.. K. Sukumara Pillai (till 24-9-80)  
.. M. P. Paul (from 24-9-80)

**Rice Research Station, Vyttila**

**Scientists**

- Assoc. Professor : Sri. P. J. Tomy  
.. T. U. George  
Dr. D. M. Thampy (from 24-9-80)
- Assit. Professor-1 : Dr. Susheela Abraham
- Jr. Assit. .. -3 : Sri. M. M. Jose  
.. P. S. Mrithunjayan  
.. Sajan George

**Supporting staff**

- Sri. S. M. Jainulabdeen  
Smt. M. J. Annakutty  
.. P. Jayamony  
.. P. George Puravath  
(from 8-10-80)  
Sri. P. Madhavankutty  
.. V. C. Bharathan Pillai  
.. Vincent Pereire (from 23-9-80)  
.. K. G. Antony  
.. K. B. Girija (till 15-3-81)  
Sri. M. J. Joseph (from 30-7-80)  
.. N. S. Reghunandan  
.. N. Vasu  
.. R. Gopal Singh  
.. P. M. Varghese

**Model Agronomic Research Station, Karamana**

**Scientists**

- Assoc. Professor-1 : Sri. K. Sivasankara Pillai
- Jr. Asst. .. -2 : .. K. P. Jagan Mohan  
.. One post vacant

**Supporting staff**

- Farm Assit. (Agri.)-3 : .. N. Madavan Nair (from 16-1-11)  
Smt. S Kamala Bai (from 9-4-10)  
Sri. M. Ravikumar (from 8-5-81)
- Administrative Assit.-1 : Sri. S. Bhaskara Pillai
- Assistant Grade II-1 : Sri. V. Leela
- Chowkidar-1 : Smt. R. Raghavan Pillai
- Peon-1 : .. P. K. Sukumaran Nair

## **Agronomic Research Station, Chalakudy**

### **Scientists**

Professor (Agronomy)	:	Dr. G. Raveendranathan Pillai (from 20-11-1980)
Assoc. Professor (Agrl. Chemistry)	:	Sri. P. R. Ramasubramanian
(Agronomy)-1	:	„ T. F. Kuriakose
(Agrl. Engineering)-1	:	Vacant
Assistant Professor (Agronomy)-1	:	Sri. Kuruvila Varghese (from 12-12-80)
(Agrl. Chemistry)-1	:	Smt. P. K. Sushama (Jr. Asst. Professor)
(Soil Physics)	:	Vacant
(Agrl. Engineering)-1	:	Sri. T. D. Raju (Jr. Asst. Professor)
Technical Assistant (Statistics)-1	:	Vacant

### **Supporting staff**

Farm Asst. Senior Grade-1	:	Sri. K. K. Chandrasenan
Farm Asst. Grade I -1	:	„ E. N. Sudhakaran Nair
Farm Asst. Grade II -1	:	„ M. T. Varghese
Laboratory Asst. Grade III -1	:	„ T. K. Velayudhan
Oil Engine Driver-1	:	„ K. A. Subran
Ploughman-1	:	„ K. C. Mathew
Administrative Assistant-1	:	„ G. Joyson
Assistant Grade II (Typist)-1	:	„ Vinaya Bai
Assistant Grade II -1	:	„ S. Vallinayakam Pillai
Jeep Driver-1	:	„ V. K. Karunakaran
Peon-1	:	„ K. Radhakrishnan

## **Research Station and Instructional Farm, Mannuthy**

### **Instructional Farm, Mannuthy**

#### **Scientists**

Assoc. Professor (Agronomy)-1	:	Dr. V. K. Sasidhar
Asst. Professor (Agronomy)-1	:	Vacant
Jr. Asst. Professor (Plant Pathology)-1	:	Sri. P. C. Rajendran
(Mech. Engg.)	:	Vacant

## **AICRIP double cropping sub-centre**

### **Scientists**

Associate Professor (Agrl. Botany)-1	:	Sri. P. D. Vijayagopal (Upto September, 1980)
Assistant Professor (Agrl. Botany)-1	:	Sri. N. Ramachandran Nair



### **Rice Research Station**

(Agri. Botany)-1 : Sri. K. Aravindakshan  
(Agri. Chemistry)-1 : .. M. A. Hassan  
(Agronomy)-1 : Smt. A. K. Babylatha

### **Adhoc Scheme for adaptive trial on annual oil seeds**

Assistant Professor Sri. K. Pushkaran  
(Plant Breeding)-1 : (Jr. Asst. Professor i/c)

### **All India Co-ordinated Agronomic Research Project**

#### **Headquarters Unit**

#### **Scientists**

Assoc. Professor (Agronomy)-1 : Sri. V. Ramachandran Nair  
(till 26-12-80)  
.. I. P. S. Nambiar (from 26-12-80)  
Asst. Professor (Statistics)-1 : .. P. Gangadharan  
(Chemistry) : Smt. S. Pushkala (till 31-7-80)  
.. G. Santha Kumari  
(from 1-8-80)  
Jr. Assistant Professor  
(Chemistry)-1 : Sri. C. S. Gopi

#### **Supporting staff**

Assistant Senior Grade-1 : Sri. Rajasekharan  
Laboratory Attender-2 : Vacant  
Attender-cum-Watchman-1 : Vacant

#### **AICARP-ECF, Calicut Unit**

Assistant Professor Sri. S. Janardhanan Pillai  
(Agronomy)-1 : (till 21-12-80)  
.. Abraham Varghese  
(from 22-12-80)

#### **Supporting staff**

Farm Assistant : Sri. P. Aboobacker  
.. P. Bhaskaran  
.. V. K. Kumaran  
.. M. J. Kochappan  
.. N. Saidalikutty  
.. K. M. Vijayakumar  
.. M. K. Chandramathy  
(till 7-4-80)  
.. A. N. Parameswaran  
(from 7-4-80)  
.. John David (till 22-12-80)  
.. Imbichi Ali (from 26-12-80)  
Asst. Grade II-1 : Sri. K. Kelappen  
Watchman-1 : .. P. C. Chandran

**AICARP-ECF, Ernakulam Unit  
Scientists**

Assistant Professor-1 : Sri. K. Sankara Panicker

**Command Area Research Centre  
Scientists -**

Professor (Agronomy)-1 : Sri. T. F. Kuriakose,  
Assoc. Professor (till 27-11-80)  
.. U Mohammed Kunju  
(from 27-11-80 to 31-1-81)  
Dr. V. K. Sasidhar  
(from 1-2-81 to 16-3-81)  
Dr. E. Thajuddin  
(from 16-3-81)

Jr. Assistant Professor-12 : Sri. V. B. Padmanabhan  
(till 5-6-80)  
Smt. Nazeema Beevi  
(from 11-6-80 to 19-9-80)  
.. K. Sudharma  
(from 1-10-80 to 1-12-80)  
Sri. P. Lakshmanan (till 29-11-80)  
.. K. N. Balakumaran  
(from 29-11-80)  
Smt. G. Sobhana (till 2-6-80)  
.. Pathummal Beevi  
(from 12-6-80 to 25-11-80)  
.. P. A. Valsala (till 1-12-80)  
Sri. B. Mohankumar  
(from 2-12-80 to 10-12-80)  
.. F. M. H. Khaleel (till 13-3-81)  
.. N. Ramachandran Nair  
(till 25-3-81)  
.. S. Kuruvila Varghese  
(till 11-12-80)  
.. Jose Mathew  
Smt. Maicykutty P. Mathew  
(till 21-11-80)  
.. K. R. Lyla (from 21-11-80)  
.. Kamalam Joseph  
.. P. Prabhakumari  
(from 3-10-80 to 1-12-80)  
.. Sumam George  
(from 16-10-80 to 2-12-80)  
.. P. Sukumari

**Supporting staff**

Farm Asst. Grade II-8	:	Sri. V. D. Thulasidas
		.. M. K. Vijayan
		.. V. Unnikrishnan
		.. T. V. Kuttichan
		.. P. N. Ratheesan
		.. V. John George
		.. S. Naseema
		One post vacant
Typist Grade II-1	:	Smt. K. K. Mary
Assistant Grade II-1	:	Vacant
Driver Grade II-1	:	Sri. V. N. Dasan (till 7-4-80)
		.. I. T. Rappai
		(from 5-7-80 to 30-8-80)
		.. K. Parameswaran (from 30-8-80)

**Operational Research project on integrated control of rice pests in Kuttanad****Scientists**

Assoc. Professor (Entomology)-1	:	Dr. M. J. Thomas
Asst Professor (Pathology)-1	:	Sri. M. G. Vasavan
		.. G. Mathai
Jr. Asst. Professor-4	:	Sri. Jim Thomas
		.. Babu George
		.. R. Harikumar
		.. G. Nandakumar
		.. K. J. Joseph
		.. C. Gokulapalan
Jr. Statistician-1	:	Smt. P. R. Krishna Kumari Amma

**Supporting staff**

Driver (Jeep)	:	Sri. K. Sukumara Pillai
		.. M. P. Paul
Driver (Boat)-1	:	Sri. M. D. Janardanan

**Regional Research Station, Pilicode-NARP****Scientists**

Assoc. Director-1	:	Sri. K. Kannan (from 20-3-81)
Professor (Horticulture)-1	:	.. K. Kannan
		(from 8-8-80 to 19-3-81)
Professor (Soil Science)-1	:	Vacant
Associate Professor-16	:	Sri. N. Neelakantan Potty
		(from 1-2-81)
		Sri. K. Balakrishna Pillai
		(from 26-11-80)
		Sri. P. K. Sathyarajan
		13 posts vacant

Assistant Professor-5 : Sri. T. C. Radhakrishnan  
(from 1-2-81)  
Sri. A. B. Mohammed Ali  
(from 26-11-81)  
Sri. K. Rajamohan (from 20-3-81)  
Two posts vacant

**Supporting staff**

Farm Assitant Grade I-5 : Sri. Basil Rodrigues  
(from 23-12-80)  
4 posts vacant

Administrative Officer-1 : Sri. P. C. Raveendran Pillai  
(from 21-3-81)

Typist Grade I-2 : Smt. K. B. Girija  
(from 23-3-81 to 25-3-81)  
One post vacant

Typist Grade II-2 : Sri. K. Gopikuttan Nair  
Smt. Salomi Silas

Laboratory Attendar-6 : Vacant

Tractor Driver (H. V.)-1 : Vacant

Photographer-cum-Artist-1 : Vacant

Peon-1 : Vacant

**Regional Research Station, Pilicode/Nileswar**

**Scientists**

Assoc. Professor-2 : Dr. P. K. Narayanan Nambiar  
Sri. N. Neelakantan Potti  
(till 31-1-81)

Assistant Professor-4 : Sri. K. Bhaskaran Nambiar  
„ P. K. Ramachandran Nair  
„ T. C. Radhakrishnan

**Supporting staff**

Farm Supervisor-1 : Sri. L. Christudas

Farm Assistant-2 : „ Basil Rodrigues  
(till 5-7-80)  
Smt. K. Rugmini Amma  
(from 5-7-80)  
Sri. A. Vijayan

Administrative Assistant-1 : Smt. C. M. Radhakutty

Assistant-5 : Sri. K. Prabhakaran Nadar  
(till 7-7-80)  
Sri. P. M. F. Babu  
(from 12-9-80)  
Sri. K. Balachandran  
Smt. S. Droupathy  
Sri. V. Narayanan  
Smt. Suma Varghese

Typist-1	:	Smt. P. Radha
Jeep Driver-1	:	Sri. T. M. Sukumaran
Driver-2	:	Sri. P. K. Sadanandan ,, C. C. Valayudhan (till 17-10-80) ,, C. C. Punnan (from 9-12-60)
Laboratory Attender-1	:	Sri. V. Narayanan
Peon-3	:	,, P. Kannan ,, K. Veluthambu ,, P. Raghavan
Watchman-1	:	,, K. Koran
Rest House Keeper-1	:	,, K. Kunhambu

**All India Co-ordinated Coconut & Arecanut Improvement Project  
Scientists**

Assoc. Professor-1	:	Sri. C. A. Joseph
Jr. Asst. Professor-2	:	,, L. Rajamony ,, B. Jayaprakash Naik

**Coconut Research Station,  
Kumarakom  
Scientists**

Professor (Agronomy) -1	:	Sri. U. Mohommed Kunju (from 9-2-81)
Associate Professor (Entomology)-1	:	Sri. B. Thomas
(Plant Pathology)-1	:	Dr. L. Rema Devi (from 9-2-81)
Assistant Professor (Plant Pathology) -1	:	Dr. Susamma Philip (25-7-80)
(Agronomy)-1	:	Vacant
(Chemistry)-1	:	Vacant
(Acqua Culture)-1	:	Sri. C. B. Rajendran (from 27-11-80)
Jr. Asst. Professor (Agrl.)-3	:	Smt. V. L. Geethakumari (from 3-1-81) Sri. Jim Thomas (from 17-2-81) ,, Abraham Varghese (till 22-12-81)
(Fishery Science)-1	:	Sri. K. G. Padmakumar (from 27-11-81)
(Acqua Culture)-1	:	Sri. V. Jayaprakash
(Vety. Science)-1	:	Vacant

**Supporting staff**

Farm Assistant Senior Grade-2	:	Smt. I. L. Indira (from 18-10-80) Sri. K. K. Viswanathan (12-12-80)
Farm Assistant Grade I & II-4	:	Smt. N. Kamalamma Sri. M. Kamarudeen (from 21-3-81) Two posts vacant

Farm Asst. (Vety.) Grade II-1	:	Sri. K. K. Sasidharan Nair
Administrative Assistant-1	:	Sri. Abubakkar Khan (from 21-7-80)
Typist Senior Grade-1	:	„ K. K. Gopikuttan Nair
Assistant Grade I & II-2	:	„ P. M. Mani Smt. Annamma Varghese
Jeep Driver-1	:	Sri. T. M. Francis (from 9-6-80)
Peon-Higher Grade-1	:	„ T. K. Sreedharan
Mazdoor-Higher Grade-1	:	„ A. K. Chacko

**Coconut Research Station,  
Balaramapuram  
Scientists**

Associate Professor (Agronomy)-1	:	Sri. E. P. Koshy
Asst. Professor (Entomology)-1	:	Smt. K. S. Remamony
(Plant Pathology)-1	:	Sri. S. Sasikumar

**Supporting staff**

Farm Asst. Senior Grade-1	:	Smt. J. Vimala
Farm Asst. Grade I-1	:	„ S. Icy
Administrative Assistant-1	:	„ K. Pankajakshy
Assistant Senior Grade-1	:	„ N. Sujatha (from 19-9-80)
Assistant Grade II-1	:	„ Jeslet Mercy
Typist Grade II-1	:	Vacant
Peon-Higher Grade-1	:	Sri. K. Velappan Nair
Mazdoor Special Grade-1	:	„ J. Enese
Watchman-Higher Grade-1	:	„ P. Sreedharan (from 19-5-80)

**Cardamom Research Station,  
Pampadumpara  
Scientists**

Assoc. Professor (Entomology)-1	:	Sri. D. Joseph
(Chemistry)-1	:	Vacant

**Supporting staff**

Farm Asst. Grade I-1	:	Smt. K. Devaky
Farm Asst. Grade II-1	:	Vacant
Administrative Assistant-1	:	Sri. C. S. Asokakumar
Typist Grade I-1	:	„ M. C. Jayakumar
Assistant Grade II-1	:	Vacant
Watchman-4	:	Sri. M. Easo „ Chacko Chandu „ K. Raghavan Pillai „ K. V. Thankappan
Jeep Driver-1	:	Sri. K. Chacko

**AICC & SI Project****Scientists**

Assoc. Professor-1	:	Dr. L. Rema Devi (upto February 81)
(Plant Pathology)	:	Sri. P. Karunakaran
(Agronomy)-1	:	Vacant
(Botany)-1	:	Vacant
(Entomology)	:	Vacant

**Supporting staff**

Fram Assistant Grade II-2	:	Sri. P. M. Poullose
	:	Sri. V. P. Prasad
Lab. Assistant Grade II-1	:	.. P. V. Joseph
Peon	:	.. K. N. Sankara Pillai

**Control of slow wilt disease of pepper****Scientists**

Jr. Asst. Professor-1	:	Vacant
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**Supporting staff**

Field Supervisor-1	:	Sri. K. N. Raghavan (from 3-12-80)
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**Horticultural Research Station, Ambalavayal****Scientists**

Assoc. Professor	
(Horticulture)-1	
Asst. Professor	
(Entomology)-1	
(Plant Pathology)-1	
(Botany)-1	
(Agronomy)-1	

Jr. Asst. Professor-2

**Supporting staff**

Administrative Assistant-1
Assistant Grade I-3
Assistant Grade II-2
Typist Grade II-1
Peon-Higher Grade-3
Farm Supervisor-2
Farm Assistant Grade I-4
Farm Assistant Grade II-2
Laboratory Assistant-2
Jeep Driver Grade I-1
Tractor Driver-1
Oil Enginer Driver-1
Pump Operetor-1
Watchman-Higher Grade-3
Watchman-Lower Grade-1
Regular Mazdoor-Higher Grade-5
Regular Mazdoor-Lower Grade-9
Budder-3

## **Lemongrass Research Station, Odakkali**

### **Scientists**

Associate Professor-1	:	Sri. E. V. G. Nair
Assistant Professor-1	:	Vacant
Jr. Assistant Professor-2	:	Sri. K. C. Rajan Smt. Alice Kurian

### **Supporting Staff**

Administrative Assistant-1	:	Sri. P. S. Kesevan Nair
Sr. Grade Assistant-1	:	Smt. P. K. Elsy
Assistant Grade I-1	:	„ V. K. Pathumma
Typist Grade I-1	:	Sri. R. Sadan (up to 22-9-80)
Office Superintendent (FC & D)-1	:	K. K. Ramachandran Nair (from 29-9-80)
Peon-1	:	M. M. Poulouse
Graduate Lab. Asst.-1	:	Smt. K. K. Santhakumari Amma
Lab Asst. Grade I-1	:	Sri. J. Dassayyan Nadar (up to 9-9-80) Sri. T. K. George (from 24-9-80)
Lab. Attender-1	:	„ M. K. Shanmughan (up to 27-3-81)
Boiler Attender-1	:	„ K. Chellappa Mooppan
Sr. Grade Agri. Demonstrator-2	:	„ E. R. Neelkanthan Nair (up to 31-7-80) „ R. Chandran Pillai (from 1-10-80) Smt. V. V. Mariyamkutty (from 1-10-80)
I Grade Agri. Demonstrator-2	:	Smt. D. Subhadramma (up to 30-9-80) Sri. E. N. Sudhakaran Nair
Sweeper-cum-Attender-1	:	Vacant
Watcher-1	:	„ K. K. Raghavan
Permanent Labourer-1	:	Sri. C. Kalidas

## **Banana Research Station, Kannara**

### **Scientists**

Assoc. Professor (Horticulture)-1	:	„ P. A. Varkey
Asst. Professor (Agronomy)-1	:	„ V. Muraleedharan Nair (till 10-12-80) „ T. M. Kurian (from 11-12-80)



Assoc. Professor (Plant Pathology)	:	„ P. C. Jose (till 20-1-80) Smt. G. Padmakumari (from 5-3-81)
(Plant Physiology)-1 Asst. Professor-1 (Plant Breeding)	:	Dr. M. N. Chandrasekharan Nair Sri. T. R. Gopalakrishnan (from 23-11-18 to 1-1-81) Sri. P. K. Rajeevan (from 2-1-81)
(Entomology)-1	:	„ Job Sethyakumar Charles (from 6-11-80)
Jr. Asst. Professor-5	:	Smt Lyla Mathew K. Sri. T. E. George (till 2-1-81) „ K. C. Aipe (from 3-1-81) Smt. K. R. Lyla (till 27-11-80) „ Maicykutty P. Mathew (from 28-11-80) „ K. T. Prasannakumari (from 26-5-80 to 22-11-80) „ Sabina George (from 22-11-80 to 2-2-81) Sri. V. V. Radhakrishnan (from 26-5-80) to 27-12-80) „ K. Sudhakaran (from 28-5-80 to 8-7-80)
<b>Supporting Staff</b>		
Farm Asst. (Agri.) Grade I-1	:	Sri. M. P. George
Farm Asst. (Agri.) Grade II-4	:	„ K. V. Natarajan „ T. Ravindran „ S. Sukumaran Nair „ P. V. Reghunathan (from 1-1-81)
Laboratory Assistant-2	:	„ P. T. Narayanan One post vacant
Clerk-Typist-1	:	„ K. A. Joy (till 9-12-80) „ Neelakantan Nair (from 23-12-80 to 29-12-80)
Oil Engine Driver-1	:	„ K. A. Narayanan
Peon-Grade II-1	:	Smt. K. V. Padmavathy
Watchman-2	:	Sri. R. Krishnan Nair
Mali-2	:	„ V. A. Ousep „ Beer Bahadur Singh

Farm Asst. Senior Grade-1	:	Sri. K.-C. Kochumon
Farm Asst. Grade I-1	:	„ T. Raveendran
Administrative Asst.	:	„ V. Balagopal (from 22-9-80) „ V. K. Balakrishnan (till 21-9-80)
Assistant Grade I-1	:	Sri. N. Vijayakumar
Driver Grade II (LV)-1	:	Sri. K. K. Thankappan
Peon-Higher Grade -1	:	Sri. T. Achuthan Nair
Watchman-1	:	Vacant

**Pepper Research Station, Panniyur  
Scientists**

Professor (Plant Breeding)-1	:	Vacant
Assoc. Professor (Chemistry)-1	:	Sri. V. Sukumara Pillai
(Botany)-1	:	Dr. K. Sivan Pillai
Asst. Professor		
(Agronomy)-1	:	Vacant
(Botany)-1	:	Vacant
(Pathology)-1	:	Sri. P. K. Unnikrishnan Nair (from 9-7-80)
Jr. Asst. Professor-3	:	Sri. A. B. Mohammed Ali (till 16-11-80)
		Sri. K. P. Mammooty One post vacant

**Supporting staff**

Farm Assistant Grade I-2	:	Sri. P. Raghavan „ V. Kunchu
Farm Assistant Grade II-5	:	Sri. P. J. Joseph „ A. Imbichi Ali (from 8-10-80 to 18-12-80) Sri. T. Mohammed Haneefa (from 18-12-80) Sri. K. A. Kurian (from 1-1-81) One post vacant
Laboratory Assistant-1	:	Sri. V. Achuthan
Administrative Assistant-1	:	„ G. Joyson (till 10-7-80) „ K. Prabhakaran Nadar (from 15-7-80)
Assistant Grade I-1	:	Smt. M. Leela
Typist Grade II-1	:	Sri. K. P. Mohan Das
Peon (Higher Grade)-1	:	„ K. Chindan
Watchman-1	:	„ M. P. Narayanan
Jeep Driver-1	:	„ K. Sreedharan
Peon-1	:	„ P. Narayanan



Jr. Assistant Professor-6 : Smt. Alice Antony (till 19-9-80)  
 Sri. S. G. Sreekumar  
 (from 1-7-80 to 18-9-80)  
 „ V. Sreekumaran  
 (from 18-8-80 to 18-9-80)  
 „ Jim Thomas  
 (from 7-11-80 to 10-2-81)  
 „ Mathew Jacob (from 5-11-80)  
 „ Shyam S. Kurup  
 (from 15-5-80 to 15-7-80)

**Supporting staff**

Farm Assistant Grade I -1 : Sri. Madhavan Pillai  
 Assistant Grade I -1 : Smt. D. Vijayamma (till 15-9-80)  
 Assistant Grade II -1 : „ M. N. Radhamma (from 27-9-80)  
 Typist Grade I -1 : Sri. G. Shanmughan  
 Peon-1 : „ G. Vasudevan (from 16-9-80)  
 Watchman : „ Man Bahadur

**Sugarcane Research Centre, Menonpara**

**Scientists**

Assistant Professor-1 : Sri. K. Chandrasekharan Nair  
 Junior Assistant Professor-1 : Vacant

**All India Co-ordinated Floriculture Improvement Project,  
 Vellanikkara**

**Scientists**

Associate Professor-1 : Sri. K. M. George  
 Jr. Asst. Professor-2 : Smt. K. K. Santha  
 „ Salikutty Joseph

**Supporting staff**

Mali-2 : Vacant

**ICAR adhoc scheme for survey, collection and evaluation of  
 germplasm of jackfruit, Vellanikkara**

**Scientists**

Associate Professor-1 : Dr. K. Kumaran  
 Jr. Assistant Professor-2 : Smt. S. Prasannakumari Amma  
 One post vacant

**Supporting staff**

Farm Assistant Grade II - : Sri. P. A. Sankutty

**All India Co-ordinated Project for research on forage crops  
 Scientists**

Associate Professor-1 : Sri. G. Raghavan Pillai  
 (Agromony)  
 Jr. Assistant Professor-1 : Smt. S. Chandini (from 2-8-80)

**Supporting staff**

Farm Assistant Grade I -2 : Smt. K. Radhamma Thankachi  
 „ H. Rachel (from 11-4-80)

Assistant Grade I -1 : „ S. Girija (from 3-5-1980)  
 Laboratory Attender-1 : Sri. Dasayyan Nadar (from 6-1-80)  
 Peon-1 : „ Maniyan (from 26-5-80)

**Instructional Farm, Vellayani  
 Scientists**

Associate Professor-1 : Sri. K. Pushpangadan  
 Asst. Professor-1 ; Smt. M. Suharban  
 Jr. Asst. Professor-4 :

**Supporting staff**

**Administrative Assistant-1**  
 Farm Supervisor-1  
 Typist Grade-1  
 Assistant-5  
 Farm Assistant (Agri)-7  
 Technician-1  
 Tractor Driver-1  
 Peon-1  
 Gardener-3  
 Scavenger-1  
 Farm Worker(Higher Grade)-13  
 Farm Worker-2  
 Watchman-2

**All India Co-ordinated Research Project on Biological control of  
 crop pests, Vellanikkara**

**Scientists**

Professor-1 : Dr. C. C. Abraham (till 17-3-81)  
 Assoc. Professor -1 : Dr. P. J. Joy (from 17-3'81)  
 Jr. Asst. Professor-2 : Smt. M. K. Sheela (till 7-11-80)  
 „ S. Pathummal Beevi  
 (from 26-11-80)  
 Sri. C. M. George (till 22-7-80)  
 „ A. M. Ranjith (from 25-7-80)

**Supporting staff**

Technical Assistant-1 : Smt. C. M. Omana  
 Farm Assistant (Agri.) Gr. I-2 : „ K. V. Eliamma  
 „ P. K. Kalyani  
 „ N. J. Eliamma

**AICRP on Agricultural Bye-products, Mannuthy  
 Scientists**

Professor-1 : Dr. C. R. Anathasubramaniam  
 (from 31-1-81)  
 Associate Professor-1 : Dr. C. R. Anathasubramaniam  
 (till 17-4-80)  
 Dr. C. T. Thomas  
 (from 17-4-80 to 31-1-81)

Assistant Professor-2 : Dr. George Mathan  
 Dr. A. D. Mercy (from 31-1-81)  
 Jr. Assistant Professor-2 : Dr. A. D. Mercy (till 8-9-80)  
 Dr. Annamma Kurian  
 (from 31-1-81)  
 Dr. Jose John Chungath  
 from (31-1-81)

**Supporting staff**

Farm Assistant (Vety.) Grade I-3 : Sri. K. Abdulrahiman  
 „ K. V. Balan  
 „ V. Sukumaran Nair  
 Assistant Grade II-1 : Smt. A. Santhakumari (till 23-9-80)  
 Sri. C. N. Viswambharan  
 (from 16-12-80) to 13-3-81)  
 Attendant-4 : Sri. R. Krishnan Nair (till 15-9-80)  
 Smt. M. V. Ammini  
 „ I. Parukutty  
 „ M. S. Ammini

**Co-ordinated Research Project on Goats, Mannuthy Scientists**

Associate Professor  
 (Geneticists)-1 : Dr. B. R. Krishnan Nair  
 (Nutrition)-1 : „ N. Kunjukutty  
 Asst. Professor (Pathology)-4 : „ T. Sreekrishnan  
 (Animal Reproduction) : „ Joseph Mathew  
 (Farm Manager) : „ B. Nandakumaran  
 One post vacant  
 Jr. Assistant Professor-3 : Dr. P. Nandakumaran  
 Two posts vacant

**Supporting staff**

Laboratory Technician-3 : Smt. P. K. Vijayamony  
 „ V. Indira  
 Sri. C. Velayudhan  
 Technical Assistant-I : Smt. V. M. Sarada  
 Senior Computer-1 : Sri. K. Krishnankutty  
 Assistant Grade I-3 : Smt. M. Baby  
 Sri. V. S. Skandakumaran  
 „ M. R. Ramachandran  
 Assistant Grade I-1 : Smt. S. Rajalekshmy Amma  
 Typist-1 : „ K. A. Valsala  
 Driver-1 : Sri. M. S. Kunju  
 Class IV Employee-19 : Sri. K. Radhakrishnan  
 „ K. Nanukuttan  
 „ M. Jabbar  
 „ K. K. Chandran  
 „ K. Sankaran Nair  
 „ V. Ponnappan  
 13 posts vacant

**Veterinary Hospital, Kokkalai, Trichur**

- Scientists-2** : Dr. K. Ramadas  
Dr. K. Venugopalan (from 31-3-81)
- Supporting staff** : Smt. K. S. Nirmala  
Sri. C. K. Lakshmanan  
,, M. Chinnavan  
,, M. Narayanankutty

**University Poultry & Duck Farm, Mannuthy**

**Scientists**

- Jr. Asst. Professor-1 ; Dr. A. Radhamma Pillai

**Supporting staff**

- Farm Asst. (Sr. Grade)-1 ; Sri. U. T. Dominic  
Farm Asst. Grade I-1 : ,, K. P. George  
Farm Asst. Grade II-1 ; M. K. Vijayakumar  
Administrative Assistant-1 : ,, P. V. Gopalakrishnan Nair  
(from 23-9-80)
- Assistant Grade I-2 : Sri. K. Balakrishnan  
Smt. C. Chandrikakumari
- Peon-2 : Sri. M. Ayyappan
- Poultry Servant-3 : ,, Kuttikrishnan Nair  
,, A. Sreedharan  
One post vacant

**Pig Breeding Farm, Mannuthy**

- Scientists-2** ; Dr. P. C. Saseendran  
One post vacant

- Supporting staff-4** : Sri. K. M. Neelakantan Kartha  
Smt. A. Leela  
,, B. Syamala Devi  
,, B. P. Annamma

**Livestock Research Station, Thiruvazhamkundu**

- Scientists-7** : Dr. C. S. James  
,, P. P. Balakrishnan  
,, M. R. Saseendranath  
(from 6-8-80)  
Dr. M. R. Balan (till 16-11-80)  
,, P. C. James (from 3-12-80)

- Supporting staff** : Sri. K. Achuthan  
,, S. Sahadevan  
,, P. P. Narayana Panicker  
(till 7-10-80)  
Sri. C. Mohammed Usman  
,, K. Shanmughan (till 22-11-80)  
Smt. K. Rugmini Amma (till 4-7-80)  
Sri. V. Unnikrishnan (till 16-12-80)  
,, C. S. Joseph (till 1-12-80)





# Appendix V

## LIST OF PUBLICATIONS

### COLLEGE OF AGRICULTURE

#### Rice

##### Scientific articles

- Abraham Varghese and Nair, K. P. M. (1980) Studies on the critical periods of weed competition in a short duration rice variety Triveni. *Agri. Res. J. Kerala*, 18 (1) : 1-7.
- Ali, A. B. M., Das., N. M., Visalakshy, A. and Rajaram, K. P. (1980) Residues of Carbofuran in rice plants and its toxicity to brown plant hopper. *Entomon*, 5 : 59-60.
- Devanesan, S. and Jacob, A. (1980) Studies on nuclear polyhedrosis of rice case worm (*Nymphula depunctalis* Guen. (*Pyrausticia*:*Lepidoptera*)) *Entomon*, 5 (5) : 277-284.
- Kumari, R. U. and Kurien, K. J. (1981) Cyst nematode *Heterodera oryzicola* on rice in Kerala-1 : Estimation of loss in rice due to *H. oryzicola* infestation in field level. *Third All India Nematology Symposium* held at T. N. A. U., Coimbatore from 13th to 15th February (Abstract)
- Kumari R. U. and Kuriyan, K. J. (1981) Cyst nematode *H. oryzicola* on rice in Kerala II : Control of *H. oryzicola* on rice by seed treatment. *Third All India Nematology Symposium* held at T. N. A. U., Coimbatore from 13th to 15th February (Abstract)
- Kurien K. J., Charles, J. S. and Sheela, M. S. (1980) Effect of nursery treatment and seedling root dip on the control of rice root nematode, *Hirschmaniella oryzae*. *Seminar on rice pest management* held at T. N. A. U., Coimbatore on 30th & 31st October (Abstract) : 14.
- Kurien, K. J. and Sheela, M. S. (1980) Effect of *Hirschmaniella oryzae* infestation on rice. *Third All India Nematology Symposium* held at T. N. A. U., Coimbatore from 13th to 15th February (Abstract).
- Kuruville, S. and Jacob, A. (1980) Studies on *Fusarium oxysporum* Schlect infecting rice brown plant hopper *Nilaparvata lugens* Stal. *Agri. Res. J. Kerala*, 18 (1):51-54.
- Kuruville, S., Jacob, A. and Mathai, S. (1980) On a new entomogenous fungus *Penicillium exalium* Crissic and Thom. affecting rice leaf hopper *Cicadella spectra*. *Entomon*, 5 (4):355.
- Lakshmanan, P., M. Chandrasekharan Nair and Ramanatha Menon, M. (1980) Comparative efficacy of certain fungicides on the control of sheath blight of rice. *Pesticides*, 25 (10):31-32.

- Nair, K. P. V. (1980) Influence of climatic factors on the population fluctuation of brown plant hopper in Kuttanad, Kerala. *Agri. Res. J. Kerala*. 18(1):55-61.
- Nandakumar, C. and Visalakshi, A. (1980) Movement of insecticides in two important rice soils of Kerala. *Seminar on rice pest management* held at T. N. A. U., Coimbatore on October 30th and 31st (Abstract):13.
- Padmaja, P. (1980) Exhaustion potential of rice in water logged rice soils-II. Paper presented at the *45th convention of Indian Society of Soil Science* held at Karnal, Haryana.
- Rajendran, P. and Aiyar, R. S. (1981) Effect of organic amendments and bio-fertilisers in relations to zinc availability in wetland rice culture. Paper presented in *National Seminar on Micronutrient in Agriculture* held at T.N.A.U. Coimbatore on 7th and 8th January, 1981.
- Padmakumari, G. and Chandrasekharan Nair, M. (1980) Sheath blight of rice. Paper presented at the *Seminar on technological constraints in yield of rice, pepper, coconut and cashew* held in connection with the Silver Jubilee celebrations of the College of Agriculture, Vellayani, December 1980.
- Pillai, K. S., Saradamma, K. and Dale, D. (1980) Field evaluation of two insect growth regulators for the management of insect pests of rice in Kerala. Paper presented at the *Seminar on rice pest management* held at T.N.A.U., Coimbatore on October 30th & 31st.
- Saradamma, K. and Dale, D. (1980) Effect of an insect growth regulator R-20458 on the development stages of *Spodoptera mauritia* (Boisd). Paper presented in the *Seminar on rice pest management* held at TNAU, Coimbatore on October 30th and 31st.
- Visalakshi, A., Ali, A.B.M., Devi, L. R. and Das, N M. (1980) The effect of Carbofuran on the rhizosphere microflora of rice. *Indian J. Microbiol.*, 20: 147-148.
- Visalakshi, A. and Nair, M.R.G.K. (1980) The problem of insecticide residues in the rice crop and its environment. *Seminar on rice pest management* held at TNAU, Coimbatore on October 30th & 31st. (Abstract): 13.

## **Coconut Arecanut Oilpalm**

### **Scientific articles**

- Achuthan Nair, M. and Sreedharan, C. (1981) Nutritional studies on oilpalm in India. Paper presented at the *International Conference on Oilpalm in Agriculture of eighties* held at Kualalampur.
- Alice K. J., Karunakaran, P. and Samraj, J. (1980) A comparative study on the rhizosphere microflora of coconut palm from diseased and healthy areas with reference to the root (wilt) disease. *Indian Coconut Journal*, June 1980 : 1-4.

Nair, M.R.G.K., Visalakshi, A. and Koshy, G. (1980) A new root infesting mealy bug of coconut. *Entomon*, 5 (3) : 245-246.

Saradamma, K., Dale, D. and Das, N.M. (1980) Response of the coconut black headed caterpillar *Nephantis serinopa* and its natural enemy complex to Diflubenzuron, a chitin synthesis inhibitor. *Seminar on technological constraints in yield of rice, pepper, coconut and cashew* held in connection with the Silver Jubilee celebrations of the College of Agriculture, Vellayani. (Abstract) : 5.

#### Popular Articles

Koshy, G. and Nair, K.K.R. (1980) കടലോരപ്രദേശത്തെ തെങ്ങു കൃഷി. *Veekshanam*, July 12th.

S. T. Mercy (1980) തെങ്ങിൻ തോട്ടങ്ങളിൽ നിന്നും കൂടുതൽ ആദായം. *Agri. Souvenir, Lakshadweep*: 28:30.

#### Spices, cocoa & other beverage crops

##### Scientific articles

Jayachandran, B. K., Sethumadhavan, P. and Vijayagopal, P. D. (1980) Preliminary trials on recovering mother rhizomes (seed rhizome) in ginger after establishment of the crop. Paper presented at the *National Seminar on ginger & turmeric*, 8th - 9th April, 1980, Calicut.

Kurien, K. J. (1981) Peppervine and nematodes associated with it. Status paper presented at the *Third workshop of the AICRP on nematode pests of crops and their control* held at T. N. A. U., Coimbatore from 10th to 13th February, 1981.

Premkumar, T., Visalakshi, A. and Nair, M R. G. K. (1980) Residues of insecticides in pepper when applied for the control of Pollu beetle. *Seminar on technical constraints in yield of rice, pepper, coconut and cashew* held in connection with the Silver Jubilee Celebrations of the College of Agriculture, Vellayani. (Abstract) : 8.

Sheela, M. S. and Venkitesan, T. S. (1981) Interrelationships of infectivity between the burrowing and root knot nematodes in black pepper *Piper nigrum* L. *Third All India Nematology Symposium* held at T. N. A. U., Coimbatore on 13th to 15 th February 1981 (abstract).

##### Popular articles

Nair, K. K. R. (1980) വാടിവിഴുന്ന കുരുമുളകു വള്ളികൾ. *Kerala Kaumudi* June 12th, 1980.

Nazeema Beevi, S. and Visalakshi, A. (1980) കുരുമുളകു പൊള്ളയാക്കുന്ന വണ്ടു. *Kerala Kaumudi* May 8th 1980.

Reghunath, B. R. (1980) Weed control in cocoa garden. *Kerala Kaumudi*, April 24th, 1980.

Reghunath, B. R. (1980) Pre-treatment of cardamom seeds as an aid to germination. *Mathrubhumi*, July 21st 1980.

Regunath B. R. (1980) Control of *Helopeltis* in cocoa, *Kerala Times daily*, April 15th, 1980.

Regunath, B. R. (1981) Intercropping pepper in coconut garden. *Mathrubhumi*, January 5th 1981.

### Cashew & Fruits

#### Scientific articles

Abraham, M. and Padmakumari, G. (1980) A new leaf spot disease of cashew. *Indian phytopath*, 33 (4).

Gopimony, R. (1980) Genomic classification of 25 banana varieties of Kerala. *Agri. Res. J. Kerala*, 18 (2)

Gopimony, R. and Marykutty, K. C. (1980) Intragroup correlations in the genomic groups of banana. *Agri. Res. J. Kerala*, 18 (1): 40-44.

Johnson, J., Lathika, P., Visalakshi, A. and Nalinakumari, T. (1980) A lycænid, *Rapala manea* Hewitson as a new pest in Kerala. *Entomon* 5 (3): 171-172.

#### Popular articles

Jayachandran, B. K. and Meera Bai, M. (1980) How to make mango trees yield. *Kerala Karshakan*, 24 (7): 12.

Jayachandran, B. K. and Meera Bai, M. (1980) A new method of propagation in mango. *Kerala Karshakan*, 24 (8): 7

Koshy, G. and Nair K. K. R. (1980) വാഴയിലകൾ തീന്തു നശിപ്പിക്കുന്ന പൂഴുക്കൾ *Kerala Kaumudi*, April 24th, 1980.

### Vegetable and tuber crops

#### Scientific articles

Ashokan, P. K. and Sreedharan, C. (1980) Effect of potash on, growth, yield and quality of tapioca variety H. 97 Paper presented at the *National Seminar on tuber crops production technology* at Coimbatore, November, 1980.

Gopimony, R. George, M. K. and Gopinathan Nair, V. (1980) Inheritance of fruit colour in normal and irradiated progenies of brinjal. *Agri. Res. J. Kerala*, 18 (2): 166-169.

Joseph P. J. and Ramanatha Menon, M. (1980) Effect of a strain of cucumber mosaic virus on growth and yield of snake gourd. *Madras agri. J.*, 67: (1) 65-66.

Kurien, S. and Kurien, K. J. (1981) Chemical control of root knot nematode, *Meloidogyne incognita* on brinjal by nursery treatment. Paper presented at the *Third All India Nematology Symposium* held at TNAU, Combatore from 13th to 15th February.

Kurien, S. and Kurien, K. J. (1981) Damage caused by *M. incognita* on brinjal. Paper presented at the *Third All India Nematology Symposium* held at TNAU, Coimbatore from 13th to 15th February.

Kurien, K. J. and Sheela, M. S. (1981) Integrated control of *Meloidogyne incognita* on brinjal. Paper presented at the *Third All India Nematology Symposium* held at TNAU, Coimbatore from 13th to 15th February.

Pillai, K. S., Saradamma, K. and Nair, M. R. G. K. (1980) *Helopeltis antonii* Sign as a pest of *Moringa olifera*. *Curr. Sc.*, 49 (7): 288-289.

Visalakshi, A. Nazeema Beevi, S., Premkumar, T. and Nair, M. R. G. K. (1980) Biology of *Leptoglossus abstralis* (Fabr) (*Corediae: Hemiptera*) a pest of snake gourd. *Entomon*, 5 (1): 77-79.

Visalakshy A., Saradamma, K. and Nair, M. R. G. K. (1980) On the use of the some insecticide treatments for the control of Tapioca chips borer *Araecerus fasciculatus* Deq. Paper presented at the *Seminar on Post Harvest Technology of Cassava* held at College of Agriculture, Vellayani during February 1980 (Abstract)

### Vegetable and tuber crops

#### Popular articles

Koshy, G. and Visalakshi. A. (1980) പച്ചക്കറിയുടെ ശത്രുകീടങ്ങൾ. *Kalpadhenu*, 7 (1): 52-55

Sheela M. S. and Nair, K. K. R. (1980) പച്ചക്കറി കൃഷി-നെമറ്റോഡ് എന്ന ശത്രു. *Kerala Karshakan*, September 1st: 14.

#### Pulses and oil seeds

#### Scientific articles

Kunju, U, M. and Abdul Salam, M. (1980) Germination of sesamum seeds under different soil moisture regimes. *Agri. Res. J. Kerala* 18 (1): 98-99.

Purushothaman Nair, N., Sadanandan, N., Nair, K. P. M. and Kunju, U. M. (1980) Effect of graded levels of phosphorus and potassium on nodulation of two varieties of groundnut (*Arachis hypogea L.*) *Agri. Res. J. Kerala*, 18 (2), 223-225.

Sasidhar V. K. and Sadanandan, N. (1980) Comparative performance of Soybean varieties in rice fallows. *Agri. Res. J. Kerala*, 18 (1):29-93

Visalakshi, A. and Nair, M. R. G. K. (1980) Effect of Phorate on growth characteristics and nitrogen content of cowpea plants. *Agri. Res. J. Kerala*, 18 (2) : 183-185.

#### Essential oils and medicinal plants

#### Scientific articles

Gopinathan Nair, V. (1980) Productive mutants in lemongrass induced by gamma rays. *Proc. Symp. Mutations in crop improvement*, Hyderabad (Abstract): 339-348.

Gopinathan Nair, V. (1980) Germplasm of induced mutants in Lemongrass. *Mut. Br. News letter*, I. A. E. A. Vienna, 15 ; 80-9.

Reghunath, B. R. (1980) A new leaf blight disease of *Catharanthus roseus* (L) *Agri. Res. J. Kerala*. 18:42-80.

### Post-harvest technology and nutrition

#### Scientific articles

Prema, L. and Menon A. G. G. (1980) Food consumption level and Nutritional status of fishermen community in Trivandrum district *Agri. Res. J. Kerala*, 18 2 : 208-212.

#### Popular articles

Kurien, K. J. (1980) Food grain storage. *Agri. College Magazine*.

Nazeem Beevi, S. and Visalakshi, A. (1980) കലവറ കീടങ്ങളും അവയുടെ നിയന്ത്രണവും. *Kalpadhenu*, 7 (3) : 103-118.

Nazeema Beevi, S. and Visalakshi, A. (1980) കലവറ കീടങ്ങൾ. *Kerala Kaumudi*, July 10th, 1980.

Prema, L. (1980) Banana Products. *Kerala Karshakan*, 5 (4).

#### Fodder crops

#### Scientific articles

Abraham, C. T., Sreedharan, C. and Raghavan Pillai, G. (1980) Effect of nitrogen and lime on the yield attributes and fodder yield of Dinanath grass. *Agri. Res. J. Kerala*, 18 (1) : 79-82.

Abraham, C. T., Sreedharan, C. and Raghavan Pillai, G. (1980) Influence of nitrogen and lime on the K/Ca+Mg) ratio of Dinanath grass (*Pennisetum pedicellatum*). *Agri. Res. J. Kerala*, 18 (2) : 213-215.

Mariappan, H, Chandrasekharan, P and Raghavan Pillai G. (1980) Effect of phosphorus and lime on the growth attributes and yield of *Stylosanthes gracilis swarty*. *Agri. Res. J. Kerala*, 18 (2) : 162-165.

Raghavan Pillai, G., Sreedharan, C. and Kamalam Joseph (1980) Performance of fodder crops under coconut garden conditions in Kerala. Paper presented at the *Second National Seminar on forage Production* at Anand.

Thomas J., Sreedharan, C. and Raghavan Pillai, G. (1980) A note on the effect of nitrogen and cutting interval on the quality of guinea grass. *Indian J. Agron.* 23.

#### Plant Protection

#### Scientific articles

Ammal, L. S. and Dale, D. (1980) Evaluation of some antifeedants against larvae of *Papilio demoleus* Linn (*Papilionidae : Lepidoptera*) and *Plusia peponis* F. (*Noctuidae : Lepidoptera*) *Agri. Res. J. Kerala*, 18 (2) : 186-190

Asari, P. A. R. and Dale, D. (1980) A few novel appliances for pest control in Kerala. Paper presented at the *First Annual Workshop on Agricultural Engineering and Technology in Kerala* held at College of Horticulture, Vellanikkara on May 28 th & 29th.

- ishnan, S. and Nair Y. L. (1980) A note on the mode of penetration of the fungus *Bacilomyces fevismisum* (Dickson Fries) Brawn & Smith into the white fly *Bemisia tabaci qluntidius*. *Sci. & Cult.* 46 (6) : 231-232
- 3alakrishnan, S., Rajan Asari, P. A. and Nair, M. C. (1980) Timer spore trap. Paper presented at the *First Annual Workshop of Agrl. Engineering and Technology in Kerala* held at the College of Horticulture Vellanikkara on May 28 and 29 th.
- 3alakrishnan, S. and Thomas, M. S. Electrophysiology in Plant Pathology. Paper presented at the *First Annual Workshop of Agricultural Engineering and Technology in Kerala* held at the College of Horticulture, Vellanikkara on May 28 th and 29 th.
- Bhavani Devi, S. (1980) A simple technique for the *in vitro* production of basidiocarp from *Vulvarilla volvacea* (Buller ex Fries) Sing. *Indian J. Microbiology*, 20 (3) : 241.
- Dale, D. Beevi, S. P. (1980) Effect of Diflubenzuron on morphological features of different growth stages of *Spodoptera mauritia* (Boisd). Paper presented at the *Seminar on technological constraints yield of rice, pepper coconut and cashew* held in connection with Silver Jubilee Celebrations of the College of Agriculture, Vellayani (Abstract).
- Krishna Das, V. S., Dale, D. and Johnson, J. (1980) Effect of juvenile hormone analogues on female moths of *Spodoptera mauritia* (Boisd) and their progenies. Paper presented at the *Seminar on technological constraints in yield of rice, pepper, coconut and cashew* held in connection with the Silver Jubilee Celebrations of the College of Agriculture, Vellayani (Abstract).
- Kuruvilla, S. and Jacob, A. (1980) Pathogenicity of the entomogenous fungus, *Bacilomyces farinosus* (Dickson Fries) to several insect pests. *Entomon*, 5 (4): 175-176
- Lakshmanan, P., and Chandrasekharan Nair M. (1980) *In vitro* toxicity of granular insecticides against *Rhizoctonia solani* Kuhn. *Madras agri. J.*, 67 (1): 59-60.
- Mathew R. K., Abraham, C. C., Visalakshi, A and Nair, M. R. G. K. (1980) On the improvement of female production in *Bracon brevicornis* Wesmael. *Entomon*, 5 (3): 173-174.
- Nair K. P. V. and Jacob, A. (1980) Influence of nuclear polyhedrosis on the moulting of larvae of *Pericallia ricini*. *Agri. Res. J. Kerala* 18 (1): 111-112
- Philip, M. B. and Jacob, A. (1980) Effect of granulosis on the food consumption, growth rate and utilization of feed by caterpillars of *Pericallia ricini* F. (*Arotidae: Lepidoptera*) *Entomon* 5, (1): 61-63.

- Philip, M. B. and Jacob, A. (1980) Histopathology of granulosis of *Pericallia ricini* (Arctidae: Lepidoptera). *Agril. Res. J. Kerala*, 18 (1): 61-63.
- Philip, M. B., Nair K. P. V. and Jacob, A. (1981) Host range of two entomogenous fungi, *S. racemosum* and *Penicillium exalicum* and safety to certain crop plants. *Entomon*, 6 (2) : 121.
- Visalakshi, A., Santhakumari, K., Koshy, G. and Nair, M. R. G. K. (1980) Biological studies as *Asqldemorpha furcata* Thumb. (*Chrysomelidae: Cassidinae: Coleoptera*). *Entomon*, 5 (3): 167-169.

**Popular articles**

- Dale, D. (1981) Insecticides of the 21st Century. *Yojana*, 9 (12) : 13-20.
- Nair, K. K. R. (1981) സസ്യസംഗരോധം, ശാസ്ത്രകേരളം August, 1980: 14.
- Nair K. K. R. [1980] നെമറോഡുകൾ. ശാസ്ത്രകേരളം, April 1980:12.
- Visalakshi, A. (1980) കീടനിയന്ത്രണത്തിൽ കീടങ്ങളുടെ ജീവിത ചക്രത്തെപ്പറ്റിയുള്ള ജ്ഞാനത്തിന്റെ ആവശ്യകത. *Kalpadhenu*, 7 [1]: 50.
- Visalakshi, A. and Koshy, G. [1980] കീടനാശിനികളുടെ അവശിഷ്ട പ്രഭാവവും പരിസര മലിനീകരണവും. *Kalpadhenu*, 7 [3]: 87-88.
- Visalakshi, A. and Padmakumari, G. [1980] വീട്ടുകീടങ്ങളും അവയുടെ നിയന്ത്രണവും. *Kalpadhenu*, 7 [3]: 84.

**Soils and Agronomy**

**Popular articles**

- Thomas Varghese. [1980] രാസവളങ്ങളുടെ കാര്യക്ഷമത എങ്ങനെ വർദ്ധിപ്പിക്കാം. കേരളകർഷകൻ, 1980 സെപ്റ്റംബർ.
- Thomas Varghese [1980] ആധുനിക രാസവളങ്ങൾ. കേരളകർഷകൻ, 1980 സെപ്റ്റംബർ.
- Thomas Varghese & Aiyer, R. S. [1980] പൊട്ടാഷ് രാസവളങ്ങൾ. കർഷകന്യൂ, 1980 മേയ് ജൂൺ.

**Farm Economics and Extension**

**Scientific articles**

- Koteswara Rao Naidu and Tampi, A. M. (1980) Levels of knowledge of tobacco farmers in East Godavari district on the improved package of practices. *Tobacco Research*, 6 [2]: 79-83.
- Koteswara Rao Naidu and Tampi, A. M. [1981] A study on the adoption of the package of practices in tobacco. *Tobacco Research*, 6 [2]: 88-93
- Kumari Sushama, N. P., Menon A. G. G. and Bhaskaran C, [1981] Adoption behaviour of selected tribes in Kerala. *Indian J. Extn. Edn.*
- Menon, A. G. G. and Prema, L. (1980) Motivational pattern of rural women in their participation in training programmes. *Indian J. Home Science*, March, June, Sept. 1980:34-38
- Sethu Rao, M. K; Patil, V. S. and Bhaskaran, C. (1980) An evaluation of the Summer Institute on Water Management in Black Soils *J. Extn. Edn.*



### articles

J. (1980) Agriculture and Christianity. *Christava Deepika*, 4 (45) 65-62.

Dale, D. (1980) A great leap forward. *Agricultural College Magazine*, 21:5-6

A. G. G. Menon, (1980) ക്രൈസ്തവ വിദ്യാഭ്യാസ സംസ്ഥാനവും കൃഷി ശാസ്ത്രപഠനവും. *Mathrubhoomi*, December 22nd, 1980

Menon, A. G. G. and Ranjan S. Karippai (1980) കൃഷി ശാസ്ത്ര വിദ്യാർത്ഥികളുടെ പ്രായോഗികപരിശീലനം. *Kerala Karshakan*, 3 (25)

Thampi, A. M. (1980) Extension Education through group action. *Agricultural Souvenir*, Lakshadweep: 31

### Soil conservation and mechanisation

#### Scientific articles

Jippu, J. (1980) Development of a seedling picking mechanism for a paddy transplanter. Paper presented at the *First Annual Workshop on Agricultural Engineering and Technology in Kerala* held at College of Horticulture, Vellanikkara during May 28-29, 1980.

Jippu, J and John. P. J. (1980) Some guidelines for achieving agricultural mechanization in Kerala. Paper presented at the *First Annual Workshop on Agricultural Engineering and Technology in Kerala* held at College of Horticulture, Vellanikkara during May 28-29, 1980.

Jippu, J. and Thomas, M. S. (1980) Popularisation of pedal paddy thresher : Prospects and problems. Paper presented at the *First Annual Workshop on Agricultural Engineering and Technology in Kerala* held at College of Horticulture, Vellanikkara during May 28-29 1980.

### Cropping patterns and farming systems

#### Popular articles

Menon, A. G. G. [1980] ലക്ഷദ്വീപിലെ വിളകൾ ഒരു പുസ്തക വിചിന്തനം. *Agrl. Souvenir*, Lakshadweep : 32-33.

## COLLEGE OF HORTICULTURE

### RICE

#### Scientific articles

Droupathi Devi. G., Vijayagopal P. D. and Sasidhar V. K. (1980) Studies on the fractional application of nitrogen on the yield of rice. *Agri. Res. J. Kerala*, 18 (1) : 23-26.

Droupathi Devi. G., Vijayagopal P. D. and Sasidhar V. K. (1980) Nitrogen use efficiency and grain yield of rice. *Agri. Res. J. Kerala*, 18 (1) : 86-81.

Mammen K. V. (1980) Pest management of rice in Kuttanad. Proc. of the *Seminar on rice pest management*, TNAU, Coimbatore : 25.

### Popular articles

Pillai P. B. and Sreedevi, P. (1980) Weedicides used in rice fields. *Chandrika*, June 23, 1980.

### Coconut, arecanut & oil palm

#### Scientific articles

Abraham, C. C. and Joy, P. J (1980). Bio-suppression of black headed caterpillar for establishing yields in coconut gardens. Paper presented at the *Seminar on technological constraints in yield of rice pepper, coconut and cashew* held in connection with the Silver Jubilee of the College of Agriculture, Vellayani December 1980.

#### Popular articles

Antony, P. C. (1980) Conserving moisture in coconut garden. *Kisan World*, 7 (5).

### Spices, cocoa & other beverage crops

#### Scientific articles

Premanathan, T., Peethambaran, C. K. and Abicheeran. (1980) Screening of ginger varieties against *Phyllosticta* leaf spot. Paper presented at the *National seminar on ginger and turmeric* held at Calicut.

Nazeem, P. A. and Nair, P. C. S. (1980) Growth & flowering in nutmeg. *Indian Cocoa, Arecanut & Spices J.*, 4 (3) : 81-84.

Mammooty, K. P. Abicheeran and Peethambaran, C. K. (1980) Rhizoctonia rot of pepper seedlings. *Indian Cocoa, Arecanut & Spices J.*, 4 : 31.

Sheela, M. S. and Venkitesan, T. S. (1981) Interrelationships of infectivity between the burrowing and root knot nematodes in black pepper (*Piper nigrum*). Paper presented at the *III All India Nematology Symposium*, 13-15 February 1981, Coimbatore.

Venkitesan, T. S. and Charles, J. S. (1980) Plant parasitic nematodes associated with turmeric in Kerala and nature of infection by root knot nematode *Meloidogyne* Sp. Paper presented at the *National Seminar on ginger & turmeric* held at Calicut.

Nair, R. V., Nair, P. C. S. and Kumaran, K. (1980) Note on a small scale cocoa drier. Paper presented at the *PLACROSYM III*.

Nair, R. V., Kumaran, K. and Peethambaran, C. K. (1980) A new disease of cocoa in Kerala. *Indian Cocoa, Arecanut & Spices J.*, 4 : 18-20.

### Cashew & fruits

#### Scientific articles

Abraham, C. C. & Madhavan Nair, G. (1981) Effective management of the tea mosquito bugs for breaking the yield barriers in cashew. *Cashew causerie*, 3 (1) : 687.

Mathew, V. and Aravindakshan, M. (1980) Effect of varying levels of NPK uptake on rainfed banana cv Palayamkodan. Paper presented at the *International Symposium*, Bangalore.

Shnan, S., Nayar, N. K. and Valsamma Mathew. (1980) Effect of artificial induction of flowering in pineapple. *Agri. Res. J. Kerala*, 18 (2) : 158-161.

### Vegetable & tuber crops

#### Scientific articles

- Akbar, S. M. and Peter, K. V. (1980) Curryleaf. In *a rapidly searchable compendium of information on cultivated fruit, vegetable, spice and nut species*. CSIRO, Australia.
- Gopalakrishnan, P. K. and Gopalakrishnan T. R. [1980] Pumpkin (*Cucurbita moschata*, *C. maxima*) in *a rapidly searchable compendium of information on cultivated fruit, vegetable, spice and nut species*. CSIRO, Australia.
- Gopalakrishnan T. R., Gopalakrishnan P. K., and Peter K. V. [1980] Variability, heritability and correlation among some polygenic characters in pumpkin. *Indian. J. agric. Sci.* 50 (12) : 925-930.
- Joseph, C. B. and Peter K. V. (1981) Effect of 2, 4-D on earliness, vegetative character and marketable fruit yield in tomato. *Indian. J. agric. Sci.* 51 (6)
- Joseph C. B. and Peter K. V. (1980) Effect of 2, 4-D on fruit yield, leaf area and floral characters in tomato. *J. Hort. Sci.* 55 (1) : 41-43
- Philip J., Peter, K. V. and Gopalakrishnan, P. K. (1981) Curry leaf - a mineral packed leafy vegetable. *Indian Hort.*, January-March, 1981.
- Mehra, C. S. and Peter K. V. (1980) Comparative efficiency of straight selection over selection through discriminant function in chilli. *Indian J. agric. Sci.*, 50 (4) : 327-330.
- Mehra, C. S. and Peter K. V. (1980) Genetic divergence in chilli. *Indian J. agric. Sci.* 50 (6) : 477-481.
- Peter, K. V. (1980) Drumstick. In *a rapidly searchable compendium of information on cultivated fruit, vegetable, spice and nut species*. CSIRO, Australia.
- Peter, K. V. and Rajmohan, K. (1980) Chekurmanis. In *a rapidly searchable compendium of information on cultivated fruit, vegetable, spice and nut species*. CSIRO, Australia.
- Ramachandran, C., Peter, K. V. and Gopalakrishnan, P. K. (1980) Chekurmanis - a multi-vit. leafy vegetable. *Indian Hort.*, April-june, 1980.
- Ramachandran, C. and Gopalakrishnan, P. K. (1980) Variability studies for biochemical traits in bittergourd. *Agri. Res. J. Kerala*, 18 (1) : 27-32

#### Popular articles

- Pillai, P. B. [1980] Vegetable cultivation in earthen pots. *Souvenir Agri. Horti. Society, Tiruchur.*
- Pillai, P. B. [1980] Better profit from tapioca. *Kalpadhenu*, August, 1980.

## **Pulses & oil seeds**

### **Scientific articles**

Ramachandran, C., Peter, K. V. and Gopalakrishnan, P. K. [1980] Variability in selected varieties of cowpea, *Vigna unguiculata*. *Agri. Res. J. Kerala*, 18 [1] : 94-97.

Viswanathan, T. V., Viswambharan, K. and Raveendran C. S. (1980) Effect of two common liming materials on the growth, nodulation and yield of cowpea, *Vigna unguiculata*. *Agri. Res. J Kerala* 18 (2).

### **Post Harvest Technology & Nutrition**

#### **Popular articles**

Droupathi, G., Vimala Raja and Marykutty, K. C. (1980). Vitamin C in plants and animals. *Kalpadhenu* (1980),

Marykutty, K. C. and Droupathi Devi, G. (1980) Thiamin in plants and animals. *Kalpadhenu*, 1980.

#### **Plant protection**

##### **Scientific articles**

George, C. M., Joy, P. J. and Abraham, C. C. (1980) On the occurrence of different species of rats in Kerala. *Agri. Res. J. Kerala* 18 : 242-245.

Jacob, S., Abraham, C. C. and Joy, P. J. (1980) Regulation of fecundity, production and female-male composition of *Bracon brevicornis* (Esm)- *Hymenoptera : Braconidae*. *Agri. Res. J. Kerala* 18 : 191-199.

Nair, K. P. V., Mammen, K. V., Pillai, K. B. and Nair, S. S. (1980) Influence of climatic factors on populations of the BPH in Kuttanad, Kerala. *Agri. Res. J. Kerala*, 18 (1) : 55-60.

Venkitesan, T. S. and Seshadri, A. R. (1980) Methods of application of DBCP C1, 2-dibromes-3-chloro isopropene for the control of plant parasitic nematodes. *Agri. Res. J. Kerala*, 18 (1) 72-73.

### **Soils & Agronomy**

#### **Scientific articles**

Antony, P. C. and Koshy, M. M. (1980) Studies on the infiltration rate in red and laterite soils at Vellayani. Paper presented at the *Seminar on Water Management Practices in Kerala*. 11-12 October, 1980.

Thomas, J. (1980) When and how much to irrigate. Paper presented at the *First Annual Workshop on Agricultural Engineering & Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28-29, 1980.

Thomas, K. J. and Thomas, E. (1980) Consolidation of naturally cemented soils. Paper presented at the *First Annual Workshop on Agricultural Engineering & Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28-29, 1980.

#### **Popular articles**

Droupathi Devi, G. and Marykutty, K. C. (1980) Role of Secondary elements in plants. *Kalpadhenu* July-August 1980.

P. B. (1980) Climatic requirements for plantation crops. *Indian farmer's digest*, 12 [11 & 12].

#### **Soil conservation & mechanisation**

Samuel J. [1980] Agricultural Engineering—An Introduction. Paper presented at the *First Annual Workshop on Agricultural Engineering & Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28–29, 1980.

Samuel, J. and Ganeshan [1980] A directory of Agricultural implements. Paper presented at the *First Annual Workshop on Agricultural Engineering and Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28–29, 1980.

Samuel, J. and John, J. [1980] Power inputs to Agriculture in Kerala. Paper presented at the *First Annual Workshop on Agricultural Engineering & Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28–29, 1980.

Samuel, J. and Sankaranarayanan [1980] A glossary of Agricultural Engineering terms. Paper presented at the *First Annual Workshop on Agricultural Engineering & Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28–29, 1980.

Samuel, J. and Sivaswami [1980] Agricultural Engineering Statistics for Kerala. Paper presented at the *Annual Workshop on Agricultural Engineering & Technology in Kerala* held at College of Horticulture, Vellanikkara, May 28–29, 1980.

#### **College of Veterinary & Animal Sciences**

##### **Cattle & buffaloes**

Ananthasubramanian, C. R., Maggie Menacherry and Devassia, P. A. [1980] Effect of feeding neem (*Azadirachta indica guss*) seed cake on growth of cross bred calves. *Kerala J. Vet. Sci.*, 11 [2] : 1202.

Prasad V., Subramaniam, M. and Ananthasubramanian, C. R. [1980] Evaluation of feeding value of tea waste for milk production in cows. [i] Effect on body weight and physiological status. *Kerala J. Vet. Sci.* 11 [2] : 185.

Prasad, V., Subramaniam, M. and Ananthasubramanian, C. R. [1980] Evaluation of feeding value of tea waste for milk production in cows. [ii] Effect on the quantity and quality of milk. *Kerala J. Vet. Sci.* 11 [2] : 192.

##### **Goat improvement**

Nair, K. B. R., Mathai, E. and Kunjukutty, N. [1980] A report on lactating male goats. *Kerala J. Vet. Sci.*, 12 [1].

Kunjiukutty, N., Annamma Kurian and Thomas, C. T. [1980] Evaluation of the nutritive value of venga [*Pierocarpus marsapium, Roxb*] leaves for goats. *Kerala J. Vet. Sci.* 11 [2] : 175-180.

### **Pig & other animals**

Reghunandan, K. V., Nair B. R. K. and Raja, C. A. R. [1980] Inbreeding depression of certain economic traits in large white yorkshire pigs. *Kerala J. Vet. Sci.*, 12 [1].

Saseendran, P. C. and Rajagopalan, T. G. (1980) The growth, carcass characteristics and economics of rearing of indigenous and exotic pigs I. Growth rate. *Indian J. Animal Science*.

### **Artificial Insemination & Animal Reproduction**

Mathai, E., Nair, B. R. K. and Neelakandan, C. P. (1980) Artificial insemination in goats with special reference to the effects of season and face of the moon on the oestrus cycle. *Kerala J. Vet. Sci.*, 11 (1).

### **Animal Diseases**

Mathew, J., and Raja, C. K. S. V. (1980) Pathological conditions of epididymis of bucks. *Kerala J. Vet. Sci.*, 11 (2).

Mathew, J., Madhavan, E. and Iyer, C. P. N. (1980) Foetal mummification in goats associated with normal parturition. *Livestock Advisor*, 5 (11).

Nair, K. P., Rajan, A. and Nair, B. R. K. (1980) Control hyperplasia of the adrenal in the buck. *Kerala J. Vet. Sci.*, 12 (1).

Rajan, A., Sulochana, S., Sreekumaran, T. and Reddi, M. V. (1980) Tumours of the Ethmoid mucosa, *Indian J. Cancer*, 17 : 196-199.

## **RESEARCH STATIONS/SCHEMES/PROJECTS**

### **Rice Scientific articles**

Indrasenan, G. and Jim Thomas. (1981) On the chemical control of Udbatta disease of rice incited by *Ephelis oryzae* (Syd) *Agri. Res. J. Kerala* 19 (1).

Ittyaverah, P. J. (1980) Weed control in direct sown rice in Kuttanad Paper presented at the *Seminar on technological constraints in yield of rice, pepper, coconut and cashew* held in connection with the Silver Jubilee celebration of College of Agriculture Trivandrum.

Jose, M. M. (1980) Studies on fish culture along with rice in pokkali fields of Kerala. Paper presented in the *Symposium on Fresh water biology*.

Pillai, S. J. and Ghosh, A. K. (1980) Influence of different herbicides on weed control in direct seeded flooded rice. Paper presented at the *Annual Conference of Indian Society of Weed Science* held on 21-23 July, 1980, at Orissa University of Agriculture and Technology, Bhubaneswar.

Radhakrishnan, T. C. (1980) A note on studies on the control of sheath blight disease of paddy caused by *Corticium sasakii* (shirai) Matsumoto I. *Macco Agril. Digest*, 4 (2)

- Radhakrishnan, T. C. (1980) Influence of moisture content on viability of paddy seeds. *Agri. Res. J. Kerala*, 18 (1).
- Sukumara Dev, V. P. (1980) Chemical control of *Helminthosporiose* of rice. *I. R. R. Newsletter* 5 (4).
- Sukumara Dev, V. P. and Gopalan, N. [1981] Field evaluation of fungicides against blast disease of rice. *Pesticides*, 15 [2] : 19-20.
- Sukumara Dev, V. P. and Satyarajan, P. K. [1980] Efficiency of certain fungicides in the control of sheath blight disease of rice. *Agri. Res. J. Kerala*, 18 [1]: 113-115.
- Thomas, M. J. [1980] Experience on integrated pest control in Kuttanad rice fields. Paper presented in the *Seminar on technological yield constraints in selected crops* at Vellayani during December, 1980.
- Thomas, M. J. and Jim Thomas. [1980] Chemical control of rice thrips *Baliothrips biformis*. Paper presented in the *Rice pest Management Seminer* held at T. N. A. U., Coimbatore on October 30th and 31st, 1980.
- Kumaran, K., Madhava Menon, P. and Rathinam, M. [1980] Hybrid inviability and weakness in certain *indica* rice crosses. *Agri. Res. J, Kerala*, 18 [1] 8-13.

#### Popular articles

- Tomy, P. J. [1980] Pokkali Cultivation-A booklet.
- Susamma Philip. [1980] നെല്ലിനുണ്ടാകുന്ന പോളരോഗം. *ശകരള കർഷകൻ* 24 : 19-20.
- Karunakaran, K. (1980) പ്രധാനപ്പെട്ട രാസവളങ്ങളും ഉൽപ്പാദനക്ഷമത കൂടിയ നെൽവിത്തുകളും. *ശകരള കർഷകൻ*
- Karunakaran, K. (1980) മോടൻ നെൽകൃഷിക്കുള്ള ഇനങ്ങളും വളങ്ങളും പ്രധാന വിളപരിപാലന ചിട്ടകളും. *കലപ്രയോഗം*.
- Sukumaradev, V. P. (1981) കീടരോഗ നിയന്ത്രണം പുതുക്കുഷിയിൽ. *മാതൃഭൂമി*, ജനുവരി, 1981.
- Mathai, G. (1981) Pest resistant rice varieties. *The Hindu Daily*, 7th January, 1981.
- Nair, N. R. and Rema Bai, N. (1980) നെൽവിത്തു കൂടുതൽ കാലം സൂക്ഷിക്കാൻ. *ശകരള കർഷകൻ*, 1980 മേയ്.

#### Coconut Arecanut, Oil Palm

##### Scientific articles

- Kannan, K. (1981) Preliminary studies on underplanting coconut garden. *Indian Coconut J.*, 11 (10).
- Neelakantan Potty. N. and Jayaprakash Naik, B. (1980) Yield improvement in coconut through the regulation of soil temperature. Paper presented in the *Seminar on technological yield constraints in selected crops* held in connection with the Silver Jubilee Celebration, College of Agriculture.

- Neelakantan Potty, N., Jayaprakash Naik, B., Rajamony, L. and Nambiar, P. K. R. (1980) Comparative performance of eight coconut varieties in red loam soil. *Indian Coconut J.* 11 (5):1-2.
- Neelakantan Potty, N. and Joseph. C. A. (1980) Comparative performance of open pollinated and T x D hybrid progenies of selected W.C.T parents in red sandy loam soils. Paper presented at the *Seminar on technological yield constraints in selected crops* held in connection with the Silver Jubilee Celebration of the College of Agriculture.
- Neelakantan Potty, N., Nambiar, P. K. R. and Jayaprakash Naik. B.(1980) Level and frequency of fertilizer application on the yield of T x D palms. Paper presented in the *Seminar on technological yield constraints in selected crops* held in connection with the Silver Jubilee Celebration of the College of Agriculture.
- Radhakrishnan, T. C. and Neelakantan Potty, N. (1980) Varietal reaction to stem bleeding disease. *Agri. Res. J. Kerala*, 18 (1).
- Rajamony, L., Neelakantan Potti, N. and Kannan. K. (1980) Environment-genotype interactions in coconut-1. Studies on soil variation and crop response. Paper presented in the *Seminar on technological yield constraints in selected crops* held in connection with the Silver Jubilee Celebration of the College of Agriculture.
- Mathai, G. (1980) Seasonal and varietal variations on the incidence of leaf rot of coconut in root (wilt) affected tracts. *Indian Cocon. J.*, 11 (6).
- Susamma Philip. (1980) Production of cellulolytic enzymes by fungi associated with the spoilage of copra. *Madras Agri. J.*, 67 (9): 603-605.
- Susamma Philip and Menon, M. R. (1980) Variations in the properties of coconut oil due to fungal infection of copra. Paper presented at the *Symposium on plant disease problems under diversification of crop production in India*, organised by society of Mycology and Plant Pathology, Udaipur.
- Susamma Philip, Menon M. R. and Alice Abraham (1980). Moisture content and succession of microflora in copra. *J. Plant. Crops*, 8 (1) : 36-37.
- Susamma Philip, Menon M. R. and Thomas, E. J. (1980) Influence of moisture and weather conditions on microbial population in copra. *J. Plant. Crops*, 8 (1) : 36-39.
- Popular articles.**
- Mathai, G. (1980) കാരാവീഴ്ച : ചില ഗവേഷണഫലങ്ങൾ. *കന്നിമണ്ണ* ഒക്ടോബർ 1980.
- Mathai, G. കാരാവീഴ്ചയും തെങ്ങിന്റെ പോഷണവും. *മേരളകർഷകൻ* ഏപ്രിൽ, 1980.
- Mathai, G. (1980) കൽപവൃക്ഷത്തോടു കരുണ കാട്ടുക. *മേരളകർഷകൻ*, ജൂലൈ, 1980.



Susamma Philip (1980) Investigations on the microbial deterioration of copra. *Vignana poshini*, 1 (1) : 60-68.

Susamma Philip. (1980) കൊപ്രയുടെ കുമിളം-ഒരു ശാസ്ത്രീയ അവലോകനം. *കലപയേന്ദു*, 7 : 117-118.

### Spices, Cocoa & other Beverage Crops

#### Scientific articles

Radhakrishnan, T. C. (1980) Occurrence of leaf blight disease of ginger at Pilicode. *Macco Agri. Digest*, 5 (4)

Chandy K. C., Pillay, V. S. and Nambiar, P. K. V. (1980) Effect of Ethyl Methane Sulphonate in the Vegetative buds of pepper. *J. Cocoa, Arecanut & Spices*, 3 (4) : 93-94.

Mammooty, K. P., Abicheeran, Sasikumaran, S. and Pillay, V. S. (1980) Symptomatological studies on the quick wilt disease of pepper. Paper presented at the *Seminar on diseases & manuring of plantation crops*, TNAU, Madurai.

Neelakantan Potty, N., Radhakrishnan, T. C., Rajamony, L and Kannan, K. (1980) An ideotype of a pepper plant for partial shade based on yield prism. Paper presented at the *Seminar organised in connection with the Silver Jubilee Celebrations of the College of Agriculture*.

Pillay, V. S. and Chandy, K. C. (1980) Grow pepper in flower pots. *Indian Hort.* April-June, 1980.

Susamma Philip. (1980) Wilt of *Vanilla planifolia* Andr. (Salisb) caused by *Fusarium oxysporum* Schl. *Agri. J. Res. Kerala*, 18 : (1) 139.

Kumaran, K., Prasannakumari, S. and Sivaraman Nair, P. C. Experiments on small scale fermentation of cocoa beans-II. Effect of the different factors for aeration on the extent of fermentation and quality of the cured beans. Paper presented in *Placrosym III*

#### Popular articles

Susamma Philip, (1981) കുറുമുളകു വാട്ടറോഗൽതെ നിയന്ത്രിക്കുക. *കേരള കർഷകൻ* 25;3-10

Joseph, D. (1980) Pests of cardamom (Technical bulletin).

Joseph, D. (1980) ഏലത്തിന്റെ കാണഡപുഴു. *ദീപിക*.

Joseph, D. (1980) ഏലത്തോട്ടത്തിൽ തേനീച്ചകളെ വളർത്തി ഉൽപാദനം വർദ്ധിപ്പിക്കാം. *കലപയേന്ദു*.

Joseph, D and Rema Devi, L. (1980) രണ്ട്ാം തവാരണ. *ദീപിക*, ജൂലായ് 1980.

Joseph, D. and Rema Devi, L. (1980) ഏലത്തിന്റെ ചെറു നാമ്പ്. *കലപയേന്ദു* 7 (5) : 153.

Joseph, D. and Rema Devi, L. (1980) ഏലത്തെ ഉല്പാദനം ആദായകരമായ ഒരു തൊഴിൽ. *കലപയേന്ദു*

Rema Devi, L. (1980) ഏലത്തിന്റെ അഴുകൽ രോഗം. *ദീപിക*.

### Cashew & Fruits

#### Scientific articles

Nazeem, P. A. and Gopikumar, K (1980) Studies on the correlation between seed and seedling characters in jack, *A. heterophyllum*. *Agri. Res J. Kerala*, 18(2): 216-217.

Susamma Philip, Wilson, K. and Abraham, M. (1980) Cigar end disease of banana. *Agri. Res J. Kerala*, 18 (1) : 128.

### **Vegetable & Tuber Crops**

#### **Scientific articles**

Ashokan, P. K., Hassan, M. A. and Neelakantan Potty. N. (1980) Quality attributes of *Colocasia esculenta*. *Agri. Res. J Kerala*, 18 (1): 102-103.

Rema Devi, L. and Menon, M. R. (1980) Transmission of *Pseudomonas solanacearum* through the seeds of tomato. *Agri. Res. J Kerala*, 18 (1): 120-122.

Rema Devi, L. and Menon, M. R. (1980) Seasonal incidence of bacterial wilt of tomato. *Indian J. Microbiol.* 20 (1): 13-15.

Rema Devi, L. and Menon, M. R. (1980) Sclerotial wilt of *Coleus Parviflorus Banth.* *Sci. & Cult.*, 46 (11) : 408.

### **Pulses & Oil Seeds**

#### **Scientific articles**

Pillai, K. B., Thomas, M. J. and Nair, N. R. (1980) *Melanagromyza azawil* (*Agromyzidae, Diptera*) as a pest of sesamum. *Agri. Res. J Kerala*, 18 (1) : 144

Santhakumari, S (1980) Performance of blackgram varieties in sandy rice fallows. *Agri. Res. J Kerala*, 18 (1) ; 100-101.

#### **Popular articles**

Santhakumari, S. [1980] Kayamkulam-2, a high yielding hybrid sesamum *Hindu*, December 18, 1980

### **Essential Oils & Medicinal Plants**

#### **Scientific articles**

Nair, E. V. G. (1980) Kerala's role in the development of essential oil industry. *Indian Perfumer.* 24 (2).

Nair, E. V. G., Chinnamma, N. P. and Pushpakumari, R. (1980) Investigations on some types of lemongrass (*C. flexuosus* steapf.) *Indian Perfumer.* 24 (1): 20-21.

Nair, E. V. G., Chinnamma, N. P. and Pushapakumari, R. (1980) Influence of spacing on the grass and oil yield of palmarosa. (*Cymbopogon martini* var. *motia*) *Indian perfumer.*, 24 (1): 25-26.

### **Plant Protection**

#### **Scientific articles**

Mathai, G. (1980) Virus insecticides for future pest control. *Macco. Agri. Digest-Research Bulletin*, 5 (7).

Nair, K. P. V., Mammen, K. V., Pillai, K. B. and Nair, S. S. (1980) Influence of climatic factors on population of the brown plant hopper in Kuttanad. *Agri. Res- J. Kerala*, 18 (1): 55-60.

- Rema Devi, L. and Menon, M. R. (1980) Suitability of different media on the isolation of *Pseudomonas solanacearum* from soils of Kerala. *Agri. Res. J. Kerala*, 18 (2): 246-247.
- Santhakumari, S. (1980) Incidence of whorl maggot in Onattukara in Kerala. *International Rice Research News letter*, 1980.
- Sukumara Dev, V. K. (1980) Sheath blight control with soil fungicides. *International Rice Research News letter*, 5 (3).
- Thomas, M. J., Pillai, K. B. and Nair, N. R. (1980) Occurrence of *Solenopsis geminata* Fabar. (Formicidae: Hymenoptera) as a predator of the brown plant hopper. *Agri. Res. J. Kerala*, 18 (1): 145.
- Thomas, M. J., Jim Thomas, and Nanda Kumar, C. (1980) Insecticidal control of rice thrips *Baliothrips biformis*. Paper presented at the *Rice Pest Management Seminar* held at TNAU Coimbatore, October 1980.
- Vasavan M. G. (1980) Herbicides in plant disease control. *IRRIN*, 5 (4).

#### Popular articles

- Joseph, D. (1980) ചീവീട് എന്ന ശബ്ദരാജൻ. ശാസ്ത്രകേരളം, ജൂലായ്, 1980.
- Mathai, G. (1980) Aquatic fern menace-Salvania. *Hindu*, October 8, 1980.
- Susamma Philip. (1980) വിത്തിലൂടെ പകരുന്ന രോഗങ്ങൾ എങ്ങനെ തീയന്ത്രിക്കാം. കേരളകർഷകൻ, 24: 12.

#### Cropping Patterns & Farming Systems

##### Scientific articles

- Radhakrishnan, T. C. and Neelakantan Potty, N. (1980) Pepper on coconut-a compatibility study. Paper presented in the *Seminar in connection with the Silver Jubilee Celebration of the College of Agriculture*.
- Sadanandan, N. and Sasidhar, V. K. (1980) Intercropping of pulses in Kerala. *Indian J. Genet.* 40: 123-125.
- Santhakumari, S. (1980) Catch crops of summer rice fallows. *International Rice Research News letter*, 1980.
- Santhakumari, S. (1980) Performance of cowpea varieties in the sandy loam rice fallows during third crop season *Agri. Res. J. Kerala* 18 (1): 60-91.
- Sasidhar, V. K. and Sadanandan, N. (1980) Comparative performance of rice in various multiple cropping patterns *Indian J. Agron.* 25 (3): 398-402.

### Popular articles

Karunakaran, K. (1980) ഉല്പാദനകൃഷിയിൽ കൃഷിയെ വിത്തിനങ്ങളുടെ വിജയകരമായ കൃഷിക്ക് ചില പ്രായോഗികമായ നിർദ്ദേശങ്ങൾ. *കന്നിമണ്ണ*, ഓഗസ്റ്റ്, 1980

### Miscellaneous

Joseph, D. (1980) തേനിച്ചകൾക്കു പരിശീലനം. *ദീപിക*

Joseph, D. (1980) തേനിച്ചകളെ സംരക്ഷിക്കാൻ. *ദീപിക*.

Johnkutty, I. and Gangadhara Menon, P. K. (1981) Permanent manurial experiments—Emphasizing manure-cum-fertilizer approach *Farmer and Parliament*, 15 (3): 23–28.

Sukumaradev, V. P. (1980) Seed testing and seed certification. (Manual for seed testing trainees).

# Appendix VI

## PROJECT CO-ORDINATION GROUPS

### AGRICULTURE

#### Rice

Project Co-ordinator : Sri. P. N. Pisharody

Members: Dr. V. Gopinathan Nair, Sri. N. Rajappan Nair, Dr. K. Karunakaran, Sri. K. I. James, Sri. T. F. Kuriakose, Sri. P. J. Tomy, Dr. V. K. Sasidhar, Sri. P. K. Gangadhara Menon, Dr. R. S. Aiyer, Sri. N. N. Ramankutty, Dr. C. C. Abraham, Dr. M. J. Thomas, Dr. M. C. Nair.

#### Coconut, arecanut & oilpalm

Project Co-ordinator : Sri. K. K. Kannan

Members : Sri. B. Thomas, Sri. E. P. Koshy, Dr. P. K. Narayanan Nambiar, Dr. C. Sreedharan, Dr. R. Vikraman Nair, Dr. T. V. Viswanathan, Dr. A. I. Jose, Dr. T. S. Venkitesan, Dr. M. C. Nair, Dr. S. K. Nair.

#### Spices, cocoa and other beverage crops

Project Co-ordinator : Dr. N. Mohanakumaran

Members : Dr. L. Rema Devi, Sri. V. Sukumara Pillai, Dr. N. Krishnan Nair, Dr. K. Kumaran, Dr. R. Vikraman Nair, Dr. C. C. Abraham, Dr. T. S. Venkitesan, Sri. S. Balakrishnan, Dr. Abi Cheeran.

#### Cashew and fruits

Project Co-ordinator : Sri. V. K. Damodaran

Members : Dr. N. Krishnan Nair, Dr. K. Kumaran, Sri. M. K. Kannan, Sri. S. Balakrishnan, Dr. N. Mohanakumaran, Sri. M. K. Mammen, Sri. P. Sethumadhavan, Dr. M. N. C. Nair, Sri. G. Sreekantan Nair, Sri. G. Madhavan Nair, Sri. P. C. Jose, Associate Professor-Cashew Research Station, Ankkayam, Associate Professor-Cashew Research Scheme, Madakkathar.

#### Vegetable and tuber crops

Project Co-ordinator : Dr. P. K. Gopalakrishnan

Members : Dr. Mary K. George, Sri. P. K. Asokan, Dr. K. V. Peter, Sri. P. Sethumadhavan, Sri. S. Balakrishnan, Dr. N. Mohanakumaran, Dr. T. S. Venkitesan, Dr. C. K. Peethambaran.

#### Pulses and oil seeds

Project Co-ordinator : Dr. V. Gopinathan Nair

Members : Dr. Mary K. George, Dr. T. V. Viswanathan, Smt. Santhakumari, Associate Professor-Pulses scheme, R. R. S. Pattambi, Dr. V. K. Sasidhar, Sri. T. F. Kuriakose, Sri. A. I. Thomas, Sri. M. R. C. Pillai, Dr. R. S. Aiyer, Dr. P. J. Joy, Dr. Abi Cheeran.

### **Essential oils and medicinal plants**

Project Co-ordinator : Dr. Mary K. George

Members : Sri. E. V. G. Nair, Dr. A. I. Jose, Sri. T. Prabhakaran, Dr. T. V. Viswanathan, Sri. M. K. Mammen, Professor of Pharmacology  
Sri. V. Sukumara Dev, Sri. G. Indrasenan.

### **Post-harvest technology & nutrition**

Project Co-ordinator : Sri. K. K. Vidyadharan

Members : Sri. C. Luckins, Babu, Dr. K. V. Mammen, Dr. Jose Samuel, Dr. K. V. Peter, Sri. P. Sethumadhavan, Sri. V. Sukumara Dev, Dr. Susamma Philip, Dr. S. K. Nair, Dr. L. Prema, Associate Professor—Agrl. By Products Scheme.

### **Sugarcane & other miscellaneous crops like cotton, jute millets etc.**

Project Co-ordinator : Dr. M. N. Namboodiri

Members : Sri A. I. Thomas, Dr. R. Vikraman Nair, Sri. S. Sukumaran, Nair, Sri. K. Ravindran Nair, Sri. P. K. Chellappan Nair, Sri. K. Chandrasekharan Nair, Dr. M. C. Nair.

### **Fodder crops**

Project Co-ordinator : Dr. C. Sreedharan

Members : Dr. V. Gopinathan Nair, Sri. G. Raghavan Pillai, K. P. Madhavan Nair, Sri. T. F. Kuriakose, Dr. M. C. Nair, Fodder Research Officer—Fodder Research Scheme, Mannuthy, Associate Professor—Livestock Research Station, Thiruvazhamkunnu,

### **Plant protection**

Project Co-ordinator : Dr. N. Mohandas

Members : Sri. K. P. Madhavan, Dr. K. P. Rajram, Dr. C. C. Abraham, Dr. Abraham Jacob, Dr. T. S. Venkitesan, Dr. T. C. Nair, Dr. Abi Cheeran, Dr. K. M. Rajan, Dr. James Mathew, Dr. S. K. Nair.

### **Soils and Agronomy**

Project Co-ordinator ; Dr. K. P. Raiaram

Members : Dr. C. Sreedharan, Dr. R. Vikrman Nair, Dr. V. K. Sasidhar, Sri, P. J. Tomy, Dr. R. S. Aiyer, Dr. P. Padmaja, Dr. A. I. Jose, Sri. P. K. Gangadhara Menon, Sri. N. N. Ramankutty.

### **Farm Economics and Extension**

Project Co-ordinator : Sri. A. G. G. Menon

Members : Sri. E. J. Thomas, Sri. K. S. Karayalar, Sri. E. R. Narayanan, Nair, Dr. V. Radhakrishnan, Dr. K. Mukundan, Dr. T. Prabhakaran Sri. P. Ramachandran Nair, Dr. A. M. Tomy.

### **Soil conservation & mechanisation**

Project Co-ordinator : Dr. Jose samuel

Members : Sri. T. P. George, Sri. P. Jacob John, Sri. A. K. George Dr. P. Balakrishna Pillai, Sri. John Thomas, Sri. K. P. Madhavan Nair.

### **Cropping Patterns and farming systems**

Project Co-ordinator : Dr. V. K. Sasidhar

Members : Sri. P. N. Pisharody, Dr. K. P. Rajaram, Sri. N. Rajappan Nair, Sri. K. I. James, Sri. K. Kannan, Dr. N. Mohanakumaran, Dr. C. C. Abraham, Dr. Abi Cheeran, Dr. Anantha Subramanyam, Dr. K. Karunakaran, Dr. R. Vikraman Nair, Sri. P. J. Tomy,

## **VETERINARY & ANIMAL SCIENCES**

### **Cattle and buffaloes**

Project Co-ordinator : Dr. C. R. Anantha subramanyam (up to 13.2.1980)

Members : Dr. M. Subramanyam, Dr. C. P. Neelakanta Iyer, Dr. R. Kalyana Sundaram, Dr. G. Mukundan, Dr. E. Sivaraman, Dr. M. Krishnan Nair, Dr. G. Nirmalan, Dr. C. K. Thomas, Dr. T. G. Rajagopalan, Dr. K. Pavithran, Dr. A. Rajan, Dr. C. S. James.

### **Goat improvement**

Project Co-ordinator : Dr. G. Mukundan.

Members : Dr. B. R. Krishnan Nair, Dr. K. M. Ramachandran, Dr. E. N. Kunjukutty, Dr. B. Nandakumar, Dr. Joseph Mathew.

### **Poultry and ducks**

Project Co-ordinator : Dr. A. Ramakrishnan

Members : Dr. C. K. Venugopalan, Dr. R. Kalyanasundaram, Dr. Maggie D. Menachery, Dr. A. Rajan, Dr. G. Nirmalan, Dr. Sosamma Iype

### **Pig and other animals**

Project Co-ordinator : Dr. T. G. Rajagopalan

Members : Dr. P. K. Abdulla, Dr. C. T. Thomas, Dr. M. Krishnan Nair, Dr. C. R. Ananthasubramanyam, Dr. G. Nirmalan.

### **Artificial insemination and animal reproduction**

Project Co-ordinator : Dr. C. P. Neelakanta Iyer

Members : Dr. V. Sudersan, Dr. P. K. Abdulla, Dr. A. Rajan, Dr. C. T. Thomas, Dr. M. S. Nair, Dr. E. Madhavan.

### **Animal diseases**

Project Co-ordinator : Dr. A. Rajan

Members : Dr. M. Krishnan Nair, Dr. E. P. Paily, Dr. P. K. Abdulla, Dr. R. Kalyana Sundaram, Dr. Jacob V. Cheeran, Dr. N. M. Aliyas, Dr. C. P. Neelakanta Iyer, Dr. P. O. George.

### **Miscellaneous**

Project Co-ordinator : Dr. R. Padmanabha Iyer

Member : Dr. P. U. Surendran, Dr. G. R. Nair, Dr. T. Prabhakaran, Dr. P. S. Pushkaran, Dr. E. Nanu.

## Appendix VII

List of New Research Schemes Approved During 1980-81

### AGRICULTURE

#### Rice

- Effect of synthetic pyrethroids on the pest complex of paddy (PG-Vellayani)
- Differential response of three early duration rice varieties to time of planting and graded doses of nitrogen (PG-Vellanikkara)
- Evaluation of different short duration paddy varieties for their suitability to Tavanur area (Tavanur)
- Evaluation of different medium duration paddy varieties for their suitability to Tavanur area (Tavanur)
- Performance evaluation of promising medium duration rice cultures under low NPK level (Pattambi)
- International rice observation nursery (Pattambi)
- Seed storage studies on rice-Evaluation of different containers for storing seeds under Kerala conditions (Pattambi)
- Dormancy behaviour of important high yielding paddy varieties cultivated in Kerala (Pattambi)
- Crop-weather effect on some of the medium, short duration rice varieties on the growth, duration, yield and uptake of nutrients [Pattambi]
- Brown plant Hopper resistant variety trial-I [Moncompu]
- Brown plant Hopper resistant variety trial-II [Moncompu]
- Screening for disease resistance [Pattambi]
- Influence of potash on the incidence of blast disease of rice-Effect of split application and time of application [Pattambi]
- Chemical control of blast disease of rice [Pattambi]
- Control of sheath blight disease of rice [Moncompu]
- Chemical control of sheath blight disease of rice [Pattambi]
- Chemical control of sheath rot disease of rice [Moncompu]
- AICRIP trials [Pattambi]
  - Uniform variety trial-1 [Kharif]
  - Uniform variety trial-2 [Kharif]
  - Uniform variety trial-3 [Kharif]
  - Preliminary variety trial-1 [Kharif]
  - Preliminary variety trial-2 [Kharif]
  - Uniform variety trial-1 [Rabi]
  - Uniform variety trial-2 [Rabi]
  - Uniform variety trial-3 [Rabi]
  - Preliminary variety trial-1 [Rabi]



- Preliminary variety trial-2 [Rabi]
- Studies on the time of planting in paddy [Chalaky, Kayamkulam, Mannuthy, Moncompu, Karamana and Cannanore]
- Studies on the different methods of sowing paddy seeds [Chalaky, Kayamkulam, Mannuthy and [Pattambi]
- Breeding of improved rice varieties for the ill-drained and temporarily flooded areas in Kerala [Pattambi]
- Chemical control of the rice nematode (*Hirschmanniella oryzae*)—Effects of nursery, soil treatment and seedling root dips (Vellanikyara)
- National screening nursery (Moncompu)
- Pesticide application for rice-cum-fish culture in pokkali fields (Vytila)
- Performance evaluation of promising medium duration rice cultures under low NPK levels [Pattambi]
- Studies on the behaviour of Jaya and Triveni varieties of rice under different fertilizer schedules in rice-rice-cowpea rotation [Tavanur]
- Effect of split application of  $P_2O_5$  on the growth and yield of rice and phosphorus availability in the soil at various growth stages of the crop (Moncompu)
- Low cost production technology in rice (Moncompu)
- Breeding high yielding tall photo-sensitive rice varieties with good straw yield specifically suited for the mundakan season of Kerala (Pattambi)
- Breeding for earliness in the varieties SR26B and H4 by induced mutation (Vytila)
- Breeding high yielding rice varieties for Pokkali area by hybridization (Vytila)
- International trial on nitrogen fertilizer efficiency in wetland rice (Pattambi)
- Effect of coal tar treated urea on the yield of low land rice under 10-20 cm depth of water (Pattambi)
- Response of rice to split application of nitrogen and potash at different growth phases (Pattambi, Chalaky, Moncompu, Kayamkulam and Vellayani)
- New insecticidal trial (NIT-3 dusts) (Pattambi)
- Mass culture techniques for the production of blue green algal cultures (Vellayani)
- Ecophysiology of azolla and its management for rice production (PG-Vellayani)
- Nitrogen management for rice cultures No. 24/20 and 47-41 (Karamana)
- Project for studying the growth and production of paddy as influenced by the changing environmental conditions (Moncompu)
- Studies on the waiting periods of insecticides recommended for paddy pest control (Vellayani)

- Control of sheath blight disease of rice with new chemicals (Pattambi)
- Utilization of azolla in rice eco-system (PG-Vellayani)
- Survival, host range and control of bacterial leaf blight of rice caused by *Xanthomonas oryzae* Dowson (PG-Vellayani)
- Spacing-cum-fertilizer trial on medium duration rice variety Mashoori in the Onattukara sandy loam tract (PG-Vellayani)
- Utilization of azolla in rice eco-system-Effect of dual culture and incorporation in first crop rice (PG-Vellayani)
- Weed control methods for semi-dry dibbled crop of rice (PG-Vellayani)
- Coconut, arecanut and oil palm**
- Progeny studies in selected coconut palms of West Coast Tall and Komadan varieties (Vellayani)
- The etiology and the ecological factors affecting the grey blight disease of coconut incited by *Pestalotia palmarum* (Balaramapuram)
- Studies on the effect of intercropping legumes in coconut garden and screening of the best crop and the variety suitable for intercropping (Balaramapuram)
- Weed control in coconut garden (Vellayani)
- Identification of pre-potent mother palm in coconut variety, Komadan (PG-Vellayani)
- Progeny studies in West Coast Tall palms of different yield groups (PG Vellayani)
- Physiological basis of degeneration in root wilt affected coconut palms
- Survey of the incidence of diseases of oil palm in Kerale (Kumarakom)
- Evaluation of super mother palms of coconut by seedling progenies (PG-Vellayani)
- Genetic divergence in coconut (PG-Vellanikkara)
- Spices, cocoa and other beverage crops**
- Pattern of development of symptom of Chenthal disease of cardamom and the histopathology of diseased plants (Pampadumpara)
- Etiology of the Chenthal disease of cardamom (Pampadumpara)
- Etiology and control of leaf blotch disease of cardamom (Pampadumpara)
- Biology and control of cardamom white fly (*Dialeurodes cardamomi*) (Pampadumpara)
- Reproductive mechanism in cardamom (PG-Vellayani)
- Effect of celmone [NAA formulation] on controlling fruit shedding in nutmeg-an observational trial [Vellanikkara]
- Effect of different planting materials on the growth, yield and quality of turmeric [Vellanikkara]
- Varietal-cum-manurial trial on turmeric [Nileshwar]
- Population density trial on turmeric [Vellanikkara]
- Blossom biological and hybridization studies in turmeric [Vellanikkara]
- Effect of plant population density, weight of planting material and time

- of planting on the growth, yield and quality constituents in turmeric [PG-Vellanikkara]
- Effect of fungicides on the control of microflora associated with the cured beans of cocoa [Vellanikkara]
- Root studies in cocoa, *Theobroma cacao* L. cv. Forastoro [PG-Vellanikkara]
- Regulation of cropping in cocoa, *Theobroma cacao*, L [PG-Vellanikkara]
- Biochemical changes and control of bacterial leaf spot of betel vine [PG-Vallayani]
- Flower bud differentiation in pepper, *Piper nigrum*. L. [PG-Vellanikkara]
- Effect of pruning on growth, quantity and quality of produce in pepper *Piper nigrum* L. [PG-Vellanikkara]
- Formulation of a key for identification of different types of pepper, *Piper nigrum*, L. [PG-Vellanikkara]
- Survey of collateral hosts of *Phytophthora palmivora* [Butler] in pepper gardens [PG-Vellanikkara]
- Quick wilt [foot-rot] disease of pepper *Piper nigrum*, L. [PG-Vellanikkara]
- Studies on the control of nematodes of ginger using nematicides and their residue analysis [Vellayani]
- Cashew and fruits**
- Relative field efficiency of insecticides in controlling the tea mosquito bug, *Helopeltis antonii* Sign. infesting cashew (Vellanikkara)
- Seedling progeny analysis in selected cashew types (PG-Vellayani)
- The ecology and control of the vector of banana bunchy top, *Pentalonia nigronervosa* Cog. (PG-Vellayani)
- Pathogenicity of the burrowing nematode, *Radophollus similis* to banana (PG-Vellayani)
- Studies on the performance of grape varieties under the agroclimatic conditions of Wynad (Ambalavayal)
- Nitrogen requirement of Kew pineapple (Kannara)
- Phosphorus requirement of pineapple (Kannara)
- Standardisation of depth of trench for planting pineapple (Kannara)
- Studies on moisture conservation for growing summer banana (Vellanikkara)
- Effect of Ethephon, NAA and GA on flowering and fruit set in mango (PG-Vellanikkara)
- Performance of clonal progenies from different yield groups and in relation to size of suckers in rainfed banana, *Musa* (AAB group) "Palayankodan" (PG-Vellanikkara)
- Potassium nutrition in rainfed banana, *Musa* (AAB group) "Palayankodan" PG-Vellanikkara)
- Floral biology and fruit development in 'Varika' and 'Koozha' types of jack (PG-Vellanikkara)

Pest complex associated with mango inflorescence and their control (PG-Vellanikkara)

Biometric studies in banana (PG-Vellanikkara)

Effect of Phorate applied for the control of bunchy top vector of banana *Pentalonia nigronervosa* (Cog.) on the plant and in soil environment (PG-Vellayani)

**Vegetable and tuber crops**

Varietal trials in brinjal, bhindi, cow pea, amaranthus, dolichos bean, pumpkin, muskmelon, cucumber, watermelon, bitter gourd and round gourd (Vellanikkara)

Effect of graded doses of NPK on the growth, yield and quality characteristics of cucumber (Vellanikkara)

Studies on the influence of size and source of propagules on the growth and yield of elephant foot yam (Vellayani)

Screening against root-knot nematodes *Meloidogyne incognita* in cow pea, brinjal and bhindi (Vellayani)

Control of root-knot nematode, *Meloidogyne incognita* on vegetables (bhindi) using newer nematicides (Vellayani)

Control of fruit flies, *Dacus cucurbitae* Coq. (Tripetidae) affecting snake gourd (Vellayani)

Studies on the effect of plant extracts and oils from plants in controlling pests of brinjal (Vellayani)

Insect growth regulators for the control of pests infesting bhindi, brinjal and cow pea (Vellayani)

Control of vegetable pests using chitin synthesis inhibitors (PG-Vellayani)

Use of synthetic pyrethroids for the control of pests of bitter gourd (*Momordica charantia* L.) and snake gourd (*Trichosanthes anguina*)

Yellow vein mosaic disease of pumpkin Kerala (PG-Vellayani)

Effect of seed size and fertility levels on the yield and quality of *Dioscorea esculenta* (PG-Vellayani)

Response of chilli genotypes to Ethephon application (PG-Vellanikkara)

Cataloguing of brinjal germplasm to isolate line (s) resistant to bacterial wilt (PG-Vellanikkara)

Induction of variability in *Abelmoschus manihot* var. Ghana by irradiation (PG-Vellanikkara)

Response of cucumber genotypes to Ethephon application (PG-Vellanikkara)

Screening for non bolting type(s) of amaranthus suited for year round planting [PG-Vellanikkara]

NPK requirements of chilli var. Pant C-1 [PG-Vellanikkara]

Incompatibility studies in sweet potato (*Ipomoea batatas*. L.) [PG-Vellayani]

Uniform regional trial on tapioca [Vellanikkara/Mannuthy]

Fertilizer trial on cassava [Vellanikkara/Mannuthy]

Intercropping trial in tapioca [Vellanikkara/Mannuthy]

Studies on the stage of harvest in tapioca [Vellanikkara/Mannuthy]  
 Initial evaluation trial on sweet potato [Vellanikkara/Mannuthy]  
 Uniform regional trial on sweet potato [Vellanikkara]  
 Fertilizer trial on sweet potato [Vellanikkara/Mannuthy]  
 Effect of growth regulators on sweet potato [Vellanikkara/Mannuthy]  
 Studies on two cropping systems in sweet potato [Vellanikkara/Mannuthy]  
 Studies on the optimum stage of harvest of sweet potato  
 [Vellanikkara/Mannuthy]  
 Initial evaluation trial on colocasia [Vellanikkara/Mannuthy]  
 Uniform regional trial on *Dioscorea esculenta* [Vellanikkara/Mannuthy]  
 Uniform regional trial on *Dioscorea alata* [Vellanikkara]  
 Collection, survey and maintenance of germplasm in winged bean  
 [Vellanikkara]  
 Morphological and cytological effects of colchicine in *Cucumis sativus*  
 L. [PG-Vellayani]

**Pulses and oil seeds**

Nutritional requirements of horsegram, *Dolichos uniflorus* Lam.  
 [PG-Vellayani]  
 Multilocal trial with high yielding multipoded sesamum cultures of  
 cross 5835 x Kayamkulam-1 at ten locations in the different parts of  
 the Onattukara tract  
 Comparative study of the effect of soil and leaf applied phosphorus on  
 the yield of cowpea [Tavanur]  
 Screening blackgram cultivars for local adaptability and grain yield  
 [Vellayani]  
 Evolution of high yielding short duration varieties of blackgram through  
 inter-varietal hybridization [Vellayani]  
 Physiological studies for nitrogen management in cowpea [Vellayani]  
 Breeding improved varieties of annual oil seed crops and their adaptive  
 trials in Kerala [Vellayani]  
 Tillage requirements of cowpea [PG-Vellayani]  
 Varietal resistance of sesamum to leaf and pod borer, *Antigastra*  
*catalaunalis* (Dupon) [PG Vellayani]  
 Genetic variability, path analysis and stability parameters in sesamum  
 [PG-Vellayani]  
 Fungal diseases of sesamum in Kerala [PG-Vellayani]  
 Varietal response to *Rhizobium* inoculation in cowpea under field  
 conditions [PG-Vellayani]  
 Influence of method of application of N and P on the growth, yield and  
 quality of black gram [PG-Vellayani]  
 Production of stored cowpea seeds from infestation by pulse beetle  
 [PG-Vellanikkara]  
 Screening of black gram genotypes under moisture stress conditions in  
 rice fallow [PG-Vellanikkara]

## **Essential oils and medicinal plants**

Weedicide trial in palmarosa grass [Odakkali]

Introduction and adaptation studies on aromatic plants under subtropical conditions [Ambalavayal]

Effect of growth substances on rhizome formation and diosgenin content of *Costus speciosus* [Ambalavayal]

Effect of NPK on the grass and oil yield and quantity of oil in lemongrass [Oddakkali]

Effect of spacing, rhizome weight and time of harvest on the yield and quality constituents in *Costus sp.* [PG-Vellanikkara]

## **Post harvest technology & nutrition**

Physico-chemical and organic treatment of vegetable seeds and selection of storage structures for prolonged storage [Vellayani]

Suitability of mango varieties for the preparation of different products by sensory evaluation [Vellanikkara]

Use of common salt to prevent post harvest deterioration of paddy grain due to inclement weather in the rice tract of Kuttanad [Moncompu]

Dehydration, packing and storage studies on fruits [PG-Vellanikkara]

## **Sugarcane and other miscellaneous crops**

Variability and heterosis in intervarietal hybrids of sugarcane [PG-Vellayani]

Genetic variability, path analysis and stability parameters in sugarcane [PG-Vellayani]

Studies on the pest complex of rose and their control measures [Vellanikkara]

Maintenance and evaluation of germplasm of crops [Vellayani]

## **Fodder crops**

Agrotechniques for seed production in *Stylosanthus gracilis* (PG-Vellayani)

Effect of N Levels on fodder production potential of sweet potato (Vellayani)

Correlation and path coefficient analysis in guinea grass (*Panicum maximum* Tacq.) (PG-Vellayani)

Shade tolerance of guinea grass var. Mackuenni under different levels of potassium (PG-Vellayani)

## **Plant protection**

Compatibility of 2,4-D and Propanil and their effectiveness in controlling weeds of paddy (Moncompu)

Screening for disease resistance-Uniform blast nursery (Pattambi)

Screening varieties/cultures for resistance to sheath blight and brown spot (Pattambi)

Utilization of lemongrass waste for mushroom cultivation (Odakkali)

Survey on the occurrence of vesicular arbuscular mycorrhiza in crop plants of Kerala (Vellayani)

Co-ordinated project for research on edible mushrooms of Kerala (Vellayani)

Effect of Fiplobenzuron on major crop pests of Kerala (Vellayani)

Investigations on the edible species of *Courinus* and standardisation of techniques for its large artificial cultivation (PG-Vellayani)

Project for studying the intensity of different weeds in different parts of Kuttanad (Moncompu)

### **Soils and Agronomy**

Utilization of eupatorium for compost making (Mannuthy)

Photofixation of nitrogen in re-inforced salvinia compost (Vellayani)

Combined use of nitrification inhibitors and blue green algae for economising nitrogen inputs under Kuttanad conditions (Moncompu)

Seasonal variation in pH, electrical conductivity, chloride, sulphate and soluble iron in soil and surface waters of Kuttanad under field conditions (Moncompu)

Tolerance (screening) studies on high yielding varieties of rice for acidity, salinity, iron, aluminium and manganese under Kuttanad conditions [Moncompu]

Evaluation of the role of elements, Ca, Mg, S and B in the nutrition of groundnut with reference to the monovalent (K) and divalent [Ca+Mg] cationic ratios (Vellayani)

The micro-morphology of the alluvial rice field soils of Kerala [Vellayani]

Nutritional status of the soil and plant in relation to the Chenthal disease of cardamom [Pampadumpara]

Effect of micro-nutrients in reducing the incidence of the Chenthal disease of cardamom (Pampadumpara)

Changes in certain physical properties of red loam soil as influenced by different fodder crops grown continuously (Vellayani)

Effect of tillage and organic amendments on the physical properties of soil and yield of cowpea on the red loam soils of Vellayani (Vellayani)

Increasing nitrogen use efficiency in upland soils (PG-Vellayani)

Studies on the moisture retention characteristics of the soils of Kerala (PG-Vellanikkara)

Influence of agro-techniques on surface run off and soil loss in hill slopes (PG-Vellanikkara)

Shade response of common rainfed intercrops of coconut. Part II- Legumes (PG-Vellanikkara)

The effect of added organic matter on the availability of macro- and micro nutrients in soils and on crop yields (Vellayani)

The effect of source, method and time of application of organic matter in improving their efficiency with respect to major nutrients applied along with it and also the uptake of micro-nutrients (Pattambi).

Water availability periods for crop-planning in rainfed conditions of Kerala (Vellanikkara)

### **Farm Economics, Extension & Statistics**

- A study of the impact of National Demonstration Programme on Paddy cultivation in Trichur District (PG-Vellayani)
- Study on the impact of agricultural programme implemented by the SFDA among farmers in Trivandrum district (PG-Vellayani)
- Impact of farm women's training in Agriculture (PG-Vellayani)
- Uniformity trials on vegetable crops (PG-Vellanikkara)
- Weather paddy-crop relationship (PG-Vellanikkara)
- Determination of the size and shape of plots for trials on cashew (PG-Vellanikkara)
- Balanced n-array designs with equal or unequal block sizes and equal or unequal replications (PG-Vellanikkara)
- Impact of Agricultural Research Stations and Farms on the cultivation of crops by the farmers of the surrounding area (PG-Vellanikkara)
- Involvement of village Panchayats in agricultural development programmes (PG-Vellayani)
- Impact of Special Agricultural Development Unit on the agricultural development of rural areas in Kerala (PG-Vellayani)
- A study of the factors related to the communication effectiveness of village level extension personnel (PG-Vellayani)
- A study of the technical competence and training needs of Agricultural Demonstrators (PG-Vellayani)
- Impact of Operational Research Project on agricultural production (PG-Vellayani)
- Socio-economic study of farmers in Ollukkara block in the command area of Peechi irrigation project (PG-Vellanikkara)
- Production and marketing of pineapple in Trichur district (PG-Vellanikkara)
- Impact of bank finance for minor irrigation in Trichur district (PG-Vellanikkara)
- Production and marketing of vegetables in Malappuram district (PG-Vellanikkara)
- Socio-economic study of farmers in Irinjalakuda block in command area of Peechi irrigation project (PG-Vellanikkara)
- Socio-economic study of farmers in Puzhakkal block in command area of Peechi irrigation project (PG-Vellanikkara)
- Role of rural farm women in the adoption of improved crop production practices (PG-Vellayani)
- ### **Soil conservation and mechanisation**
- Hydraulics of border strip irrigation on level or nearly level rice fields [PG-Vellanikkara]
- Development of portable axial flow pumps [PG - Vellanikkara]
- Utilization of *Salvinia molesta* (African payal) for biogas production [PG-Vellanikkara]
- Development of small scale dredging equipment [PG - Vellanikkara]



Design and development of vegetable seed drier (s) [Vellanikkara]  
Development of solar energy operated refrigeration system for rural areas.  
(Vellanikkara)

Design and development of an efficient oven (chula) for rural and urban areas [Vellanikkara]

Design and development of an experimental solar engine [Vellanikkara]

Feasibility of testing and evaluation of selected implements [Vellanikkara]

### **Cropping patterns and farming systems**

Studies on banana based cropping pattern -Inter cropping with tapioca, groundnut, cowpea and bittergourd [Vellanikkara]

Evaluation of different cropping sequences for their suitability to Tavanur area [Tavanur]

## **VETERINARY AND ANIMAL SCIENCES**

### **Cattle**

Lucerne meal as an ingredient in calf starter

Studies on whey proteins of milk from induced lactation in cows

Comparison of Jersey and BrownSwiss crossbreds for certain economic traits

Relationship between part lactation and complete lactation milk yield in crossbred cattle

A comparative study of the ability of BrownSwiss and Jersey crossbreds for efficient milk production in hot humid tropics

Evaluation of crossbred bulls by progeny testing

### **Goat**

Optimum level of protein in concentrate mixtures of kids for growth

Chemical composition of milk of crossbred goats

Properties of milk fat of crossbred goats

### **Poultry**

Lipid transfer in chicken ovary

Replacement value of livermeal in layer rations

Evaluation of different litter materials for layers

Keeping quality of shell eggs during summer

Pattern of growth in domestic fowl

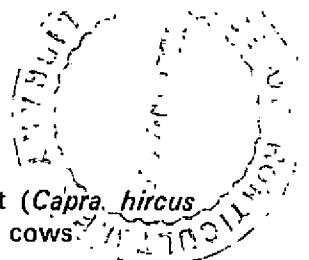
Utilisation of meat-cum-bone meal in broiler ration

Evaluation of economic layer ration evolved at the Central Institute of Fisheries Technology

### **Pig & other animals**

Growth and carcass characteristics of pigs maintained on rations containing different levels of dried tapioca chips

Pig-rearing based on utilisation of frog leg trimmings in the farmers' field



### **Animal Reproduction**

- A study of pattern of reproduction in exotic cows
- Observations on the gestation and parturition in goat (*Capra hircus*)
- Postpartum reproductive performances of crossbred cows
- Reproductive performance of crossbred heifers
- Observations on parturition in crossbred cows

### **Animal diseases**

- Nematodes of domestic carnivores in Kerala
  - An assessment of antifertility property of *Embeliaribes*
  - Susceptibility of ducks to New Castle disease virus [NDV] and their role in the transmission of the disease to chicken
  - Effect of Coccidiostat of antibody response to New Castle disease vaccine in chicken
  - Effect of *Ascaridia galli* infection on New Castle disease [Ranikhet disease] vaccination
  - Studies on non-specific anorexia in cattle
  - Study on the influence of cattle keeping on the bacteriological quality of domestic well-water
  - Chloral hydrate as general anaesthesia for goats
  - Studies on convulsive seizures in goats in Kerala
  - Efficiency of coconut [*Cocos nucifera*] water as an oral fluid and electrolyte therapy for dehydration in diarrhoeic calves
  - Treatment of fracture of tibia in calves and its radiographic evaluation
  - The role of parrots in the epizootology of New Cattle disease
  - Incidence and pathology of pneumonia in goats
  - Pathology of the reproduction organs in experimental hypothyroidism in goats
  - Embryomortality in poultry
  - Effect of immobilization on healing of fractures of long bones in calves
  - Ameliorative effect of indigenous plant drugs in experimental liver injury
  - Restraint of animals by pharmacological methods using projectile syringe
  - Studies on metabolic activity of avain ovary
- ### **Miscellaneous**
- Incomplete block designs of equal or unequal block sizes with equal and unequal replications
  - A study of plantation based mixed farming systems

## Appendix VIII

### STATUTES AND AMENDMENTS ISSUED DURING 1980-81

SRO/410/80	Draft statutes for the post of Technical Assistants [Notification No. G. O. [MS] 126/80/AD dated, 15-4-'80]
GA/84679/78	Amendment to statutes SRO No. 293/72 dated, 15-6-72
SRO/112/80	Draft Statutes for the post of Director of Physical Plant
SRO/583/80	Draft statutes for the post of Radiographer
21592/A3/80	Amendment to SRO 838/74
22591/A3/80	Amendment to SRO 266/72
22528/80	Amendment to SRO 575/76
22532/80	Amendment to SRO 334/72.