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KERALA AGRICULTURAL DEVELOPMENT PROJECT

RESEARCH PROJECTS



COLLEGE OF HORTICULTURE
KERALA AGRICULTURAL UNIVERSITY
VELLANIKKARA-KERALA

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KERALA AGRICULTURAL DEVELOPMENT PROJECT :

AN INTRODUCTION

The Kerala Agricultural Development Project (KADP) was prepared by the Government of Kerala (GOK) with the assistance of an FAO/IBRD Co-operative Programme Mission which visited India in 1975. An International Development Association (IDA) Appraisal Mission visited India in May/June 1976 and prepared an appraisal of the KADP. Negotiations were held at Washington between the IDA and representatives of the Government of India (GOI), Agricultural Refinance and Development Corporation (ARDC), GOK and the Rubber Board (IRB) in December 1976. The Executive Directors of IDA approved the Project at its meeting held on February 17, 1977. The project agreements to be executed in connection with the KADP, viz., the Development Credit Agreement (DCA) between the GOI and IDA, the ARDC agreement between the ARDC and IDA and the Kerala Project Agreement (KPA) between the GOK and IDA were signed at Washington on April 1, 1977.

THE PROJECT :

The KADP has, as its main objective, the improvement in productivity of major foreign exchange earning tree crops and pepper, with emphasis on improving the economic status of the small holder farmer. The project comprises the following programmes:

- i. New planting of high yielding coconut in 5000 ha. in Cannanore, Kozhikode and Malappuram districts;
- ii. Rehabilitation of coconut, including replanting of senile and unproductive trees in 30,000 ha. in areas free of root wilt disease in Cannanore, Kozhikode, Malappuram and Trivandrum districts;
- iii. Provision of minor irrigation facilities in project coconut areas - 1000 ha. in new planting areas and 7500 ha. in rehabilitation areas;
- iv. Intercropping in coconut areas in 26,500 ha. of various garden crops without irrigation; about 3000 ha. of cocoa, about 3000 ha. of fodder for dairy cattle and about 2500 ha. of other crops with irrigation;
- v. Rehabilitation, including replanting of pepper 10,000 ha. in Cannanore, Idukki, and Kottayam districts;
- vi. Rehabilitation of a State-owned cashew plantation of 2280 ha. and new planting of 1470 ha. in Cannanore district;
- vii. Establishment of about 435 ha. of seed gardens for coconut, cashew, cocoa and spices;
- viii. Establishment of ten crumb rubber factories (nine new and one expansion) each of 10 ton/day capacity;
- ix. Strengthening of research by CPCRI, KAU and IRB and training and technical assistance and
- x. Provision of improved extension services and investment credit facilities for project participants.

The project costs spread over a period of seven years total \$ 69 million (Rs. 62.10 crores). The proposed IDA credit of \$ 30 million (Rs. 27 crores) would cover 44% of the project costs. Of the remaining 56%, 10% would be financed by GOI and GOK, 39% by the ARDC lending banks and other participating agencies and 7% would come from small holders' own resources.

RESEARCH:

The important crops dealt with under the KADP are coconut, cocoa, pepper and cashew. The Kerala Agricultural University (KAU) and Central Plantation Crops Research Institute (CPCRI) have been doing research on many aspects of these crops. But the research input on these crops has been meagre considering the importance of these crops in the national economy. In order to tackle the various problems concerning the production of these crops, research efforts have to be intensified to provide research support to the KADP. This research support will also be useful for the future development of these crops in the State. The detailed technical programme as per the approved project is given in appendix I.

TRAINING:

The Kerala Agricultural University and CPCRI will provide the necessary technical training to the staff of the Special Agricultural Development Unit (SADU) who is mainly entrusted with the task of implementing the KADP in the State. The training includes both orientation and on-the-job training. KAU & CPCRI are also expected to provide training to farmers as per the programme.

P C SIVARAMAN NAIR
Associate Dean

APPENDIX I

INDIA

KERALA AGRICULTURAL DEVELOPMENT PROJECT

Agricultural Research, Training and Technical Assistance

(Costs Rs. '000)

	I year	II year	III year	IV year	V year	Total	%
CPCRI (Research on coconut)							
Equipments	731.5	731.5	...	...	163.6	1,463.0	60
Staff	143.9	148.9	153.8	158.7	163.6	768.9	...
Trials	100.0	100.0	100.0	100.0	100.0	500.0	...
Training overseas	67.0	67.0	66.0	...	...	200.0	100
Consultants	396.0	396.0	396.0	...	...	1,188.0	85
Sub total	1,438.4	1,443.4	715.8	258.7	263.6	4,119.9	63
CPCRI (Research on pepper)							
Equipments	478.5	478.5	...	...	...	957.0	60
Staff	195.4	201.9	207.8	213.6	220.0	1,038.7	...
Trials	20.0	20.0	20.0	20.0	20.0	100.0	...
Training overseas	67.0	67.0	66.0	...	...	200.0	100
Sub total	760.9	767.4	293.8	233.6	240.0	2,295.7	34
Total CPCRI	2,199.3	2,210.8	1,009.6	492.3	303.6	6,415.6	53
KAU							
Building	500.0	..	...	...	...	500.0	20
Equipments	1,550.0	1,550.0	...	...	...	3,100.0	60
Vehicles	410.0	...	...	...	...	410.0	30
Staff	207.0	215.3	223.6	231.9	240.1	1,117.9	...
Training overseas	100.0	150.0	150.0	...	...	400.0	100
TOTAL KAU	2,767.0	1,915.3	373.6	231.9	240.1	5,527.9	45
Total before contingencies	4,966.3	4,126.1	1,383.2	724.2	743.7	11,943.5	49
Total (including 5% physical contingencies)	5,214.0	4,332.0	1,452.0	760.0	781.0	12,539.0	49

1/3 consultants for six months each (6,000 US Dollars fee plus 1000 Dollars allowances per man month; plus three times 2000 Dollars for travel from abroad.

1. Institute Code No. : KADP AG. 2.19.1.
2. ICAR Code No. :
3. Name and address of Res. Institute/Centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on coconut
Title of the problem : Survey of gardens to select superior genotypes which are high yielding and resistant or tolerant to major pests and diseases.
5. Name and designation of Principal Investigator : K. Kannan, Professor of Horticulture (Coconut)
6. Name (s) and designation of Associate (s) : P. K. Rajeevan, Instructor, (Horticulture)
7. Location : Main Campus, Vellanikkara
8. a) Objectives : To survey and select high yielding palms which are tolerant/resistant to pests and diseases.
b) Practical utility : The existence of some healthy and high yielding palms in the midst of diseased palms in certain areas clearly indicates the possible tolerance or resistance in such genotypes. Therefore detailed survey will be conducted throughout the state to isolate such palms.
9. Technical Programme : 1) A detailed survey of the main cocount growing areas in all the districts of Kerala will be conducted with a view to spot out palms that are high yielding and tolerant / resistant to pests and diseases. A record of such palms will be maintained with all the necessary details and they will be inspected atleast twice in an year and a continuous record of yield capacity, infestation of pests and diseases and the manurial and cultural practices adopted will be recorded atleast for three years. When undesirable characters are noted subsequent to first selection, they can be also eliminated.
2) *Inter se* crosses will also be made from such selected palms and seeds will be sown for further studies.
3) Such selected palms will also be utilised as parents for hybridisation work.
10. Date of start : August 1978
11. Likely date of completion : 1982
12. Estimated man months : 8 man months / year
13. Facilities required : Staff as per the approved project
14. Financing organisation : KADP—Research and Training
15. Approximate cost : Rs. 5000/- year

(Sd)

PRINCIPAL INVESTIGATOR.

1. Institute Code No. : KADP AG. 2.19.2
2. ICAR Code No. : ...
3. Name and address of the Res. Institute/centre : Coconut Research Station, Pilicode
4. Title of the project : Research on coconut
Title of the problem : Evolving high yielding varieties which are tolerant or resistant to different pests and diseases
5. Name and designation of Principal Investigator : K. Kannan, Professor of Horticulture (Coconut)
6. Name (s) and designation of associates (s) : P. K. Rajeevan, Instructor (Horticulture)
Asst. Prof. Plant Pathology (Vacant)
7. Location : Coconut Res. Station, Pilicode, Vellanikkara, Kumarakom Balaramapuram and Kayamkulam
8. a. Objectives : To evolve high yielding coconut varieties which are tolerant or resistant to various pests and diseases
b. Practical utility : The hybridisation programme will help in selecting high yielding varieties which are tolerant or resistant to pests and diseases and thereby help in increased production
9. Technical programme : Hybrids will be produced at Coconut Res. Station, Pilicode, using various selected combinations of different varieties of coconut both exotic and indigenous. The seedlings will be screened for their resistance or tolerance to important pests and diseases under natural and artificial conditions at Nileswar, Vellanikkara, Kumarakom, Balaramapuram and Kayamkulam. The hybrids which are found to be tolerant or resistant to pests and diseases in the seedlings stage will be planted out in the field and detailed studies on their performance under field conditions will be made
10. Date of start : 1978
11. Likely date of completion : 10 years
12. Facilities required : Existing facilities at C. R. S. Pilicode will be sufficient for the nursery studies
13. Estimated man months. : Two man months for the first year
14. Financing organization : KADP - Research and Training
15. Approximate cost : Rs. 2000/- for the first year

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 2. 19. 3
2. ICAR Code No. :
3. Name and address of the Res. Institute/Centre : Coconut Res. Station, Pilicode
4. Title of the project : Research on coconut
Title of the problem : Fixing up selection criteria for hybrid coconut seedlings at nursery stage
5. Name and designation of Principal Investigator : Sri. P. K. Rajeevan, Instructor (Horticulture)
6. Name (s) and designation of Associate (s) : 1. Sri. K. Kannan, Professor of Horticulture (Coconut)
: 2. Sri. P. K. Ramachandran Nambiar, Res. Officer
7. Location : Coconut Res. Station, Pilicode and Main Campus, Vellanikkara
8. a. Objectives : Wide variations are noticed in respect of age at first flowering, annual yield of nuts, nut size, copra content, bearing habit etc. in F_1 progenies of hybrid seedlings. By fixing up selection criteria in the nursery stage based on certain morphological characters and by eliminating undesirable hybrids it is expected to reduce the variations to a considerable extent.
- b. Practical utility : The selection criteria fixed up if strictly adhered to would help in eliminating or at least minimising the variations in the F_1 progenies of hybrid seedlings.
9. Technical programme : Hybridisation will be done at C. R. S. Pilicode using various combinations of Talls and Dwarfs for production of hybrid seed-nuts. The nuts will be sown in the nursery and the following observations will be recorded at quarterly intervals.
1. Germination period (seed nuts will be sown without storage immediately after harvest and the germination period will be taken as the time from sowing to germination)
 2. Girth at collar
 3. Number of leaves
 4. Height
 5. Colour variation in seedlings
 6. Splitting time taken
 7. Bio-chemical markers such as N. A. R. (Only surface mulching or uniform shading will be given in the nursery)
- The seedlings after recording observations for a year will be planted out in the field at the Main campus, Vellanikkara for further studies.
10. Date of start : 1977
11. Likely date of completion : 10 years
12. Estimated man month : Two man months for the first year
13. Facilities required : Existing facilities at Coconut Res. Station, Pilicode will be sufficient for the nursery studies
14. Financing organisation : KADP-Res. earch and training
15. Approximate cost : Rs. 2,000/-for the first year

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 2.19.4.
2. ICAR Code No. :
3. Name and address of the research institute/centre : College of Horticulture, Vellanikkara
4. Title of the project : Research on coconut
 Title of the problem : Nutritional studies in coconut - the effect of micro-nutrients on the yield growth and disease resistance in coconuts
5. Name and designation of the Principal Investigator : K. Kannan, Professor of Horticulture (Coconut)
6. Name and designation of Associate (s) : Sri. P. A. Wahid Associate Professor. (KADP)
7. Location : Instructional Farm, Vellanikkara
8. a. Objectives : To find out the effect of important micro-nutrients on the growth yield and pest and disease infestation on coconut
 b. Practical utility : Micro-nutrients are found to have a significant effect on growth yield and disease tolerance. Therefore it is necessary to find out their utility in increasing production of coconut.
9. Technical programme : The three year old L. O. coconut variety available at the Instructional Farm, Vellanikkara will be utilised for the experiment. Application of micro-nutrients through soil and leaf at two levels will be tried. The growth as measured by the number of leaves produced, the flowering, fruit-set, yield, infestation of pests and diseases will be recorded. The plants will be given uniform manurial treatment @ 0.5 kg N, 0.32 kg P₂O₅ and 1.2 kg K₂O in addition to 50 kg green leaf / year / palm and 2 kg. dolomite / palm/ year. Uniform plant protection measures will be undertaken.
- Design : Split plot
 No. of treatments : 62 (31 for foliar application and 31 for soil application)
 No. of replications : 3
 No. of plants / treatment / replication. : 2
 Total plants : 372
 Soil application : 1. 150, 300 g. of Zn. SO₄/ plant/ year
 2. 100, 200 g. Mn. SO₄ ..
 3. 100, 150 g. of Borax ..
 4. 4, 8 g. of Amm. molybdate ..
 Singly and in combination
- Foliar spray : 5. Zn - 0.2 and 0.5% Zn SO₄
 6. Mn - 0.5 and 1% Mn SO₄
 7. B - 0.05 and 0.1% Borax.
 8. Mo - 0.01 and 0.2 ppm. Amm. Molybdate
 Singly and in combination
- Frequency of application : 1. Soil application once in a year
 2. Foliar spray twice in a year (The total quantity will be divided into equal doses)

Foliar spray : T1 - Zn1 T11 - Zn1 + Mn1 + B1
 T2 - Mn1 T12 - Zn1 + Mn1 + Mo1
 T3 - B1 T13 - Mn1 + B1 + Mo
 T4 - Mo1 T14 - Zn1 + B1 + Mo1
 T5 - Zn1 + Mn1 T15 - Zn1 + Mn1 + B1 + Mo1
 T6 - Zn1 + B1
 T7 - Zn1 + Mo1 T16 to T30 - Second level of nutrients in
 T8 - Mn1 + B1 the same combinations as above
 T9 - Mn1 + Mo1 T31 - control
 T10 - B1 + Mo1

Soil application : T1 to T31 Nutrients at the rate of specified in the same combinations as mentioned in the case of foliar application

Observations : 1. Girth at collar
 2. Height of seedlings
 3. Total no. of leaves on the crowns during the year
 4. No. of leaves produced during the year
 5. Interval of leaf production
 6. Percentage of setting
 7. Yield
 8. Size of nuts by wt.
 9. Copra production per tree/year
 10. Soil analysis for major and minor nutrients
 11. Leaf analysis for major and minor nutrients
 12. Uptake of nutrients and its retention
 13. Incidence of pests, diseases etc.

10. Date of start : Aug- Sept. 1978
 11. Likely date of completion : 10 years
 12. Estimated man months : 4 man months/year
 13. Facilities required : Staff and equipments as per the KADP programme
 14. Financing organisation : KADP - research and training
 15. Approximate cost. : Rs. 10,000/- per year

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 2. 19.5
2. ICAR Code No. :
3. Name and address of the research institute/centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on coconut
Title of the problem : Nutritional studies on Coconut – II simple fertilizer trials in cultivators' field, under different soil types, both on irrigated and rainfed conditions.
5. Name and designation of Principal Investigator : K. Kannan, Professor of Horticulture (Coconut)
6. Name(s) and designation of Associate (s) : P. A. Wahid Assoc. Prof.
7. Location : Cultivators' field in the KADP project area in Cannanore, Kozhikode Malappuram and Trivandrum districts atleast 4 plots in each major soil types / district.
8. a) Objectives : To fix an economical level of fertilizer required for coconuts under rainfed and irrigated conditions in different soil types in Kerala.
b) Practical utility : To provide a most economical dose of N, P and K to coconut under rainfed and irrigated conditions.
9. Technical programme : A survey of the coconut gardens in the KADP project area will be conducted from January 1978 and 40 gardens having 80 suitable bearing palms of uniform age will be selected for the trial. Pre-treatment data will be collected for 2 years.
- No. of palms / treatment / replication : 4
Design : RBD
Treatments : 4
Replications : 5
Treatments : 1) Cultivators' practice (50 kg organic matter) + 2kg dolomite
2) 0.34kg N + 0.17kg P + 0.68 kg K
3) 0.5kg N + 0.32kg P + 1.2kg K
4) 1 kg N + 0.5kg P + 2 kg K / palm/year in two split doses
A uniform dose of 2kg of dolomite and 50 kg green leaves or compost will also be given to treatments 2, 3 and 4. Flowering, fruit set, yield and disease and pest infestation will be recorded. The leaf and soil analysis will also be conducted once in a year. In the case of irrigated plots the fertilisers will be split into 4 doses.
10. Date of start : Aug - Sept. 1978
11. Likely date of completion : 1983
12. Estimated man months : 12 man months/year
13. Facilities required : Staff and laboratory as per the approved programme under DADP
14. Financing organisations : KADP Res. and Training
15. Approximate cost : Rs. 32,000 per year. This includes only the cost of fertilizers. The expenditure on cultural operations have to be met by the cultivators. The incidental charges for transporting etc. will also borne by them.

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 2. 19. 6
2. ICAR Code No. :
3. Name and address of the Res. Institute/Centre : College of Horticulture, Vellanikkara
4. Title of the project : Research on coconut
Title of the problem : Response to irrigation water use efficiency and cost benefit ratio under limited and ample supply of water.
5. Name and designation of Principal Investigator : K. Kannan, Professor of Horticulture (Coconut)
6. Name and designation of Associate(s) : P. K. Rajeevan, Instructor (Horticulture)
7. Location : Cultivators' field in the Project area
8. a) Objectives : To assess the irrigation requirements, water use efficiency and to work out the cost benefit ratio
b) Practical utility : Water is one of the most important inputs limiting the coconut production. Therefore the correct assessment of the water requirements will be useful for increasing the production in coconut.
9. Technical programme : Irrigation requirements and the frequency vary according to soil types. Therefore it is necessary to find out the optimum requirement under different soils types. The soil is classified into. 1. Laterite 2. Loam 3. Sandy for the purpose of this experiment and the holdings are classified into two categories i. e. limited water and ample water supply, according to availability of water. The trials proposed under ample and limited supply will be conducted on the above three soil types. Each district (KADP Districts) will have two experiments each for soil types. For the 4 districts there will be 24 experiments under each category.

Treatments under limited water supply.

1. Basin irrigation 50% depletion
2. " 75% "
3. " 75% " + mulch
4. " 75% " + mulch + conservation bands
5. Drip irrigation — equal quantity of water required for basin irrigation at 50% depletion.
6. Drip irrigation—half the quantity of water required for basin irrigation at 50% depletion.
7. Sub surface irrigation (tube)
8. " + with half the quantity of item 7
9. No irrigation
10. Sprinkler irrigation — This will be tried as an extra block single replicate treatment for comparison.

Design

Note: Guard row will be provided with atleast four plants per treatment per replication.

: R B D

Treatments under rainfed condition for young plants

1. Deep pit
2. Shape of pit and orientation (to avoid incidence of direct light.)
3. Mulching
4. Mulching + dripping through earthen pots
5. Live shade (annuals) around basins + gram crops—banana outside the pit at the beginning and close of monsoon.
6. Intercropping and micro climate regulation.
7. Application of salt and wood ash during December.
8. Digging around the plant and increasing infiltration.
9. Ploughing/digging the entire plot to increase infiltration.
10. Control (dry shade no tillage, tillage only in pits)

Treatments under rainfed condition for adult plantation.

1. Tillage (two ploughings or diggings)
2. One ploughing, bund formation and dismantling
3. Husk buried in bands
4. Husk buried in trenches
5. Growing intercrops with high organic residues and incorporate
6. Growing intercrops helping water conservation and micro climate regulation e. g. banana, groundnut etc.
7. Mulching basins
8. Growing cover crops (Calapogonium)
9. Normal plantation with only tillage.

Treatments under mixed plantations:

1. Basin irrigation at 50% depletion for coconut.
2. Basin irrigation only for perennial intercrops at 50% depletion (cacao, nutmeg/clove)
3. Basin irrigation to coconut + basin irrigation to intercrops at 50% depletion
4. Basin irrigation + annual intercrops
5. Flood irrigation to coconut and intercrops at 50% depletion
6. Sprinkler irrigation to coconut and intercrops at 50% depletion
7. No irrigation

10	Date of start	May 1978
11	Likely date of completion	: May 1985
12	Estimated man months	: 8 man months/year
13	Facilities required	: Staff and equipments as per KADP Programme
14	Financing organisation	: KADP Research and Training
15	Approximate cost	: Rs. 25,000 per year

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 2. 19. 7
2. ICAR Code No. :
3. Name and address of the Research institute/centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on coconut
 Title of the problem : Determination of pre-potency of hybrid coconuts to produce high yielding progenies
5. Name and designation of the investigator : K Kannan, Professor of Horticulture (Coconut)
6. Name (s) and designation of the Associate (s) : P. K. Rajeevan, Instructor (Horticulture)
 : P. A. Valsala, M. Sc. (Hort.) Student
7. Location : Farms under the University and Department
8. a. Objectives : To select pre-potent high yielding hybrid coconut palms with a view to produce high yielding progenies for distribution to the public
 b. Practical utility : The Department has planted sizeable number of hybrid coconut seedlings in the Dist. Agrl. Farms at Neriamangalam, Mavelikkara, Peringamala and on the bunds of Kayamkulam kayal. Many of these palms have come into bearing and yield heavily. In the case of the plantations at Neriamangalam and Mavelikkara the hybrid seedlings consist of T x D, D x T, T x G, Laccadives and other exotics etc. On theoretical basis the seednuts produced on the hybrids of these isolated plots of coconut should be considered as synthetics. It is well known that synthetics in any crop yield better than the true breeding line where cross pollination is the rule.
 While distributing the hybrid seedlings from the Research Stations and Farms, it has been made a policy to enlighten the farmers that the seednuts produced from these hybrid seedlings should not be used for production of seedlings, since these progenies are not likely to yield equally well as their parents (hybrid seedlings distributed). However, studies made under the University at Nileswar have shown that the natural crosses produced from hybrid T x D can be profitably used for producing seedlings of a high quality in terms of yield. Based on this observation it is proposed to utilize the hybrid palms available in the Departmental Farms mentioned above to produce seedlings for determining the pre-potency.
9. Technical programme : A detailed survey of the main coconut gardens in the districts of Kerala, where dwarf coconut cultivars are available, will be made to select out dwarf types based on the criteria for selection of good palms already available. These good palms will be crossed with selected tall palms as mothers. More than one female parent will be crossed with one dwarf parent. Bi-parental progenies so obtained in each of the crosses will be studied separately for their performance. Larger the number of dwarf plants involved in the bi-parental crosses, better will be the selection of the parents.

A record of all the palms involved in the crosses will be maintained with all the necessary details and they will be inspected periodically. The investigations of the progeny will be undertaken in the Farms under the University and Department and selection of parents for future crosses will be made based on the results of the bi-parental progeny analysis.

- 10. Date of start : 1978
- 11. Likely date of completion : 1990
- 12. Estimated man month : 8 man months / year
- 13. Facilities required : Staff and Laboratory as per the approved programme under KADP
- 14. Financing organisation : KADP – Res. and Training
- 15. Approximate cost : Rs. 10,000 per year.

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP AG. 2. 19. 8
- 2 ICAR Code No. :
- 3 Name and address of research institute/centre : Coconut Res. Station, Pilicode
- 4 Title of the project : Research on coconut
Title of the problem : Assessment of combining ability of dwarf coconuts
- 5 Name and designation of the Principal Investigator : K. Kannan, Professor of Horticulture (Coconut)
- 6 Name (s) and designation of the associate (s) : P. K. Rajeevan, Instructor (Hort.)
- 7 Location : Farms under the University and Department
- 8 a. Objectives : To select dwarf coconut palms which have general combining ability as well as high specific combining ability.
b. Practical utility : The Coconut Research Station at Nileswar has been producing T × D hybrid seedlings for the past few years. There has been very good demand for these seedlings. Even now there is great demand. But a large number of cultivators who planted the hybrid seedlings feel disconted now due to inconsistent bearing and other adverse characteristics of such palms. In certain cases the performance also has not been upto expectation. This has led to serious criticism.

It is essential to make sure that the hybrid seedlings distributed by the University and Department are good performers. This is all the more important when the distribution has to be done in urban areas where the land available for planting coconut is very much limited. A household may be able to accommodate only 2 or 3 seedlings. If the performance of such small number, which has been accommodated with great difficulty, cannot be ensured, such a programme is likely to fail in future. In the context of constraint for availability of land in Kerala for planting coconut, which is likely to occur in rural area also, this investigation is of utmost importance. The present study would enable in increasing the yielding ability of the progenies which would be obtained in crosses involving selected parents of high combining ability.

- 9 Technical programme : Selection of hybrid palms available in the Departmental Farms mentioned above will be made for collection of seednuts which have been formed by natural crosses, based on the criteria now available for selection of mother palms for the collection of seednuts. The seednuts collected from each of the selected hybrid palm will be sown separately in the nurseries. The seedlings so raised will be studied for their characteristics in relation to the criteria already available for selection of quality coconut seedlings. An examination of the percentage of the quality seedlings raised from each hybrid palm would give an idea of the capacity of the hybrid palm to produce quality coconut seedlings when out-crossed (pre-potency). When the seedlings obtained from each selected hybrid palm are studied, it would be possible to screen those

hybrid palms which are relativeiy more potent and these palms will be selected for the production of quality seedlings later on.

A record of all the palms involved in the study will be maintained with all the necessary details and they will be inspected periodically. The investigations will be undertaken in the farms under the University and the Department

- 10 Date of start : 1978
- 11 Likely date of completion : 1982
- 12 Facilities required : Staff and equipment as per approved programme under KADP
- 13 Estimated man months : 8 man months/year
- 14 Financing organisation : KADP-Research and Training
- 15 Approximate cost : Rs.10,000 per year

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 2. 19. 9
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : Kerala Agricultural University, Vellanikkara.
- 4 Title of the project : Research on coconut
Title of the problem : Studies on the sex ratio regulation in *Bracon brevicornis*
- 5 Name and designation of the Principal Investigator : Dr. C. C. Abraham, Professor of Entomology
- 6 Name (s) and designation of Associate (s) : Smt. Sosamma. M. Sc. (Ag.) student
- 7 Location : College of Horticulture, Vellanikkara.
- 8 a. Objectives : To identify the factors regulating the sex ratio of *Bracon brevicornis* and to evaluate their relative importance and thereby to standardise laboratory rearing techniques to ensure optimum sex ratio in successive generations.
b. Practical utility : Mass rearing under laboratory conditions will be possible only if there is sufficient number of female parasites in the parental population. Further more, the efficiency of released parasites very much depends on the presence of adequate number of females in the released material. Identification of critical factors regulating sex ratio will be helpful to manipulate rearing techniques for rapid build up of parasite number and also to ensure their efficiency under field conditions.
- 9 Technical programme : The influence of host density, adult nutrition, sex ratio of parental population, sex of host larvae etc. under diverse temperature-humidity conditions will be studied by successively rearing the parasite for a few generations and monitoring the sex ratio of filial generations.
- 10 Date of start : 1979
- 11 Likely date of completion : 1980
- 12 Estimated man months :
- 13 Facilities required : Available facilities will be utilised
- 14 Financing organisation : KADP. Research & Training
- 15 Approximate cost :

(Sd)
PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 2. 19. 10
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute / Centre : Kerala Agricultural University, Vellanikkara.
- 4 Title of the project : Research on coconut
- Title of the problem : Studies on the sex ratio regulations in Bethylids (*Perisierola nephantidis*) and to ascertain their relative importance.
- 5 Name and designation of Principal Investigator :
- 6 Name (s) and designation of Associate (s) :
- 7 Location : Horticultural College, Vellanikkara.
- 8 a) Objectives : To identify the factors regulating sex ratio of *Perisierola nephantidis* and to ascertain their relative importance.
- d) Practical utility : Optimum sex ratio among the parental population is one of the prime factors regulating parasite population build up under laboratory conditions. Identification of important factors governing sex ratio regulation will help to manipulate rearing methods to ensure rapid laboratory multiplication and this will in turn improve the possibility of bio-control of *Nephantis serinopa* using Bethylid parasites.
- 9 Technical programme : The influence of host density, adult nutrition, sex ratio of parental population, sex of host larvae etc. under diverse temperature-humidity conditions will be studied by successively rearing the parasite for a few generations and monitoring the sex ratio of filial generations
- 10 Date of start : 1979
- 11 Likely date of completion : 1980
- 12 Estimated man months :
- 13 Facilities required : Available facilities will be utilised
- 14 Financing organisation : KADP-Research and Training
- 15 Approximate cost :

(Sd)

PRINCIPAL INVESTIGATOR.

- 1 Institute Code No. : KADP AG. 2. 19. 11
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : Kerala Agrl. University, Vellanikkara
- 4 Title of the project : Research on coconut
- Title of the problem : Studies on the temperature—humidity tolerance of the Bethyloid parasite (*Perisierola nephantidis*)
- 5 Name and designation of Principal Investigator :
- 6 Names and designation of Associate(s) :
- 7 Location : Horticultural College, Vellanikkara
- 8 a) Objectives : It has been reported that the field recovery of the bethyloid parasite in the west coast is unsatisfactory. Whether the climatological features in the west coast, characterised mainly by relatively higher levels of humidity, are deleterious to the parasites, can be studied by studying the humidity tolerance of the parasite at various amelient levels of temperature.
- b) Practical utility : Proper appraisal of the importance to ambiotic weather components, mainly temperature and humidity, will be helpful to recommend releases in synchrony with optimum weather conditions.
- 9 Technical programme : Stock cultures of *Perisierola nephantidis* will be reared under diverse R. H. levels. viz. 50%, 60%, 70%, 80% and 90% maintained by keeping KOH solutions of required strength in desicators. The influence of relative humidity will be studied at constant temperature levels of 25°C, 27°C and 29°C. The progeny production, sex ratio of the offspring, fecundity, longevity etc. of the parasite will be studied under the above conditions.
- 10 Date of start : 1979
- 11 Likely date of completion : 1980
- 12 Estimated man months :
- 13 Facilities required :
- 14 Financing organisation : KADP Research and Training.
- 15 Approximate cost :

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 2. 19. 12.
2. ICAR Code No. :
3. Name and address of the Research Institute/Centre : Kerala Agrl. University, Vellanikkara.
4. Title of the project : Research on coconut
Title of the problem : Studies on the evaluation of the Tachinid parasite (*Spogossia bezziana*) in endemic areas.
5. Name and designation of Principal Investigator :
6. Name(s) and designation of Associate(s) :
7. Location : Ponnani and Badagara
8. a. Objectives : To ascertain the relative influence of *Spogossia bezziana* as a biological control agent against *N. serinopa*.
b. Practical utility : To release *Spogossia* against *Nephantis* based on the information obtained from 8 (a).

Note:- The preliminary trials conducted at the CPCRI have indicated that it is very difficult to mass multiply the parasite under lab. conditions. At present the cultures are not available at the CPCRI. Unless we get nucleus material from Sri Lanka through CIBC, this project cannot be commenced.

9. Technical programe : In endemic areas, *Spogossia bezziana* parasites will be released once in every week in isolated pockets and the population fluctuation of the pest and the extent of parasitism, ascertained at weekly intervals from random samples. Population fluctuations of the host and the parasites will be monitored from an isolated garden in the same tract which is maintained as control. The influence of parasitism on host population densities will be ascertained by working out regression equations.
10. Date of start : 1979
11. Likely date of completion : 1982
12. Estimated man months :
13. Facilities required :
14. Financing organisation : KADP - Research and Training
15. Approximate cost :

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP AG. 2. 19. 13
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on coconut
Title of the problem : Biological control of rhinoceros beetle (*Oryctes rhinoceros*)
- 5 Name and designation of Principal Investigator :
- 6 Name (s) and designation of Associates :
- 7 Location : Horticultural College, Vellanikkara
- 8 a. Objectives : To evaluate the biological control agents against the rhinoceros beetle (*Oryctes rhinoceros*) and to formulate specific recommendations.
- b. Practical utility : Biological control will be more effective against adult *Oryctes* beetles since these are concealed feeders which remain protected from insecticide stimulus. *Platymerus leavicolis* (Reduviidae) and *Rhabdionvirus oryctes* have been established to be quite effective against the adults and the fungus *Metarrhizium anisopliae* against grubs of *Oryctes*. The formulation of suitable biological control methods against *Oryctes* should ensure better pest control at low cost.
- 9 Technical programme : i. *Rhabdionvirus* will be imported from Malaysia through CIBC while *Metarrhizium* and *Platymerus* cultures will be obtained from the CPCRI. Lab multiplication procedure will be standardised and periodical colonisation will be attempted by treating manure pits with *Metarrhizium* and monitoring grub/pupal populations.
- ii. Rearing *Oryctes* adults collecting large numbers from field and releasing males and females artificially contaminated by the *Rhabdionvirus* material.
- iii. Releasing *Platymerus* at periodic intervals.
- These trials will be multilocational involving the use of one particular biotic agent in one locality. Control plot will also be maintained which do not receive the influence of the biotic agent. The host population fluctuations and also the visual symptoms rating will be monitored to evaluate the influence of the biotic agents. The most effective method will be thus identified and further studies on the optimisation of the dosage will be carried out. The most suitable timing for release of the natural enemies into the ecosystem will be worked out.
- 10 Date of start :
- 11 Likely date of completion :
- 12 Estimated man months :
- 13 Facilities required :
- 14 Financing organisation : (Sd)
- 15 Approximate cost :

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 2. 19. 14
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on coconut
Title of the problem : Survey of the microbial pathogens of the red palm weevil (*Rhynchophorus ferrugineus*) in endemic areas of the State.
- 5 Name and designation of Principal Investigator :
- 6 Name (s) and designation of Associate (s) :
- 7 Location : Muthukulam and Haripad Block areas
- 8 a. Objectives : To ascertain whether microbial pathogens are associated with grubs and pupae of the weevil and to explore the feasibility of their mass culture and utilisation of pest management.
- b. Practical utility : Chemical control against the pest is not quite successful since active stages are concealed within the trunk/boll/crowns and early diagnosis is very difficult. The utilisation of microbial pathogens by adult contamination techniques will be useful to initiate epizootics and bring about pest population reduction.
- 9 Technical programme : The palms which are badly damaged beyond recovery will be cut open and the immature stages collected from the trunk/boll/crown. Infected insects will be brought to laboratory and symptomatology studied. The causal organism/organisms will be isolated and identified and reinoculated to verify pathogenicity. Mass culturing procedure for the promising pathogens will be standardised and field application through adult contaminations or other suitable inoculation technique will be attempted. The population reduction in treated areas will be monitored by setting up traps.
- 10 Date of start : 1978
- 11 Likely date of completion :
- 12 Estimated man months :
- 13 Facilities required :
- 14 Financing organisation :
- 15 Approximate cost :

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP AG. 5(a) 19. 1
- 2 ICAR Code No. :
- 3 Name and address of Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on pepper
Title of the problem : Breeding varieties of pepper with desirable characters
- 5 Name and designation of Principal Investigator : S. Balakrishnan, Professor of Horticulture (Pepper)
- 6 Name(s) and designation of Associate (s) : Dr. P. C. Sivaraman Nair, Associate Dean
- 7 Location : University Main Campus, Vellanikkara
- 8 a. Objectives : To evolve high yielding, wilt resistant/tolerant varieties with high oleoresin content. Two methods will be employed.
i. Planned hybridisation with desirable parental combinations
ii. Exploitation of natural heterogeneity of the crop by raising large number of open pollinated seedlings and screening them for desirable characters
- b. Practical utility : The production and productivity of pepper can be considerably improved by evolving varieties of desirable characters
- 9 Technical programme : The progenies raised from open pollinated seedlings and by planned hybridisation work will be planted and they will be screened for desirable characters. For open pollinated studies, the varieties such as Panniyur-1, Kalluvally, Karimunda and Kottanadan will be utilised.
- 10 Date of start : April 1979
- 11 Likely date of completion : 1989
- 12 Estimated man months : 120/year
- 13 Facilities required : Facilities are already available
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost (Per year) :
- | | |
|------------------|--------------------|
| a. Staff | Rs. 5,000 |
| b. Equipments | ..... |
| c. Contingencies | Rs. 4,000 |
| Total per year | <u>Rs. 9,000/-</u> |

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5 (a) 19.2
- 2 ICAR Code No. :
- 3 Name and address of Research Institute / Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on pepper
Title of the problem : Training and pruning trials on pepper
- 5 Name and designation of the Principal Investigator : S. Balakishnan
Professor of Horticulture (Pepper),
- 6 Name(s) and designation of the Associate (s) : P. K. Rajeevan, Instructor (Horticulture)
- 7 Location : University Main Campus, Vellanikkara
- 8 a) Objectives : To find out the best method of training and pruning of pepper for regular high production of quality produce
- b) Practical utility : Study will help in increasing the yield and improving the quality of pepper
- 9 Technical programme : Two trials will be conducted,
1. Standardisation of pruning technique in bearing pepper
 2. Standardisation of training and pruning of young pepper vines
- Trial I. Standardisation of pruning technique in bearing pepper.**
Pepper produces spikes on the leaf axils of the current season's growth. Therefore, the optimum leaf growth required for maximum photosynthetic activity for producing economical crop has to be ascertained. The pruning trial is intended to find out the extent of pruning required for bearing pepper vines.
- Treatments: 5**
1. Control (No pruning)
 2. Pruning 25% of laterals
 3. " 50% "
 4. " 75% "
 5. " 100% "
- (Pruning will be removal of old growth, retaining a specific length of the laterals)
- The pruning will be repeated with different sets of plants at monthly intervals just after the harvest of the crop till June in order to find out the best time for such pruning.
- Trial II. Standardisation of training and pruning of young pepper vines.**
The objective is to develop laterals even from the first year onwards restricting the terminal growth.
- Treatments : 5**
1. Usual training allowing to grow to 6 metre height.

2. Vines will be lowered during second year and allowed to develop more number of shoots.
3. As in 2+ pruning the shoots in the 2nd year.
4. Terminal shoots will be pruned six months after planting and thereafter at six monthly intervals.
5. Pruning as in 3+ pruning the secondary branches to develop tertiary branches.

10	Date of start	:	June 1978	
11	Likely date of completion	:	June 1985	
12	Estimated man months	:	84	
13	Facilities required	:	Existing facilities are sufficient	
14	Financing organisation	:	KADP Research and Training	
15	Approximate cost (per year)	:	a) Pay of staff	Rs. 5,000
			b) Equipments	nil
			c) Contingencies	Rs. 6,000
			Total per year	<u>Rs. 11,000</u>

(Sd)

PRINCIPAL INVESTIGATOR

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1. Institute Code No. : KADP AG. 5 (a) 19.3
2. ICAR Code No. :
3. Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on pepper
Title of the problem : Spacing cum standard trial on pepper
5. Name and designation of Principal Investigator : S. Balakrishnan, Professor of Horticulture (Pepper)
6. Name(s) and designation of Associate (s) :
7. Location : University Main Campus, Vellanikkara
8. a. Objectives : To find out the optimum spacing and standard for pepper for getting maximum yield per unit area
- b. Practical utility : The study will help in increasing the yield of pepper per unit area
9. Technical programme : 3 types of standards and 4 different spacings
Standards:
1. Dead wood post (Teak)
2. *Erythrina indica*
3. *Garuga pinnata*
Spacings :
1. 2 M x 2 M
2. 2½ M x 2½ M
3. 3 M x 3 M
Varieties :
1. Panniyur - 1
2. Karimunda
10. Date of start : April 1979
11. Likely date of completion : May 1985
12. Estimated man months : 84
13. Facilities required : Existing facilities are sufficient
14. Financing organisation : KADP Research and Training
15. Approximate cost (per year) :
- | | | |
|------------------|-----|---------------|
| a. Pay of staff | Rs. | 5,000 |
| b. Equipments | | nil |
| c. Contingencies | Rs. | 6,000 |
| Total per year | Rs. | <u>11,000</u> |

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5 (a) 19.4
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on pepper
Title of the problem : Micronutrient trials on pepper
- 5 Name and designation of the Principal Investigator : S. Balakrishnan, Professor of Horticulture (Pepper)
- 6 Name(s) and designation of Associate (s) : P. A. Wahid, Assoc. Professor
: Asst. Professor (Soil Science)
- 7 Location : University Main Campus, Vellanikkara
- 8 a. Objectives : To find out the optimum requirements of micronutrients and their effect on the quality and quantity of the produce and the incidence of the diseases
- b. Practical utility : To increase the yield and to improve the quality of pepper and to reduce disease incidence.
- 9 Technical programme : The following four nutrients at three levels will be tried singly and in combination keeping one control (without micronutrients)
Spray treatment will be twice in a year. Calcium and magnesium will be given as dolomite in addition to 100, 40, 140 g. of NPK/vine/year
- | | |
|--------------|----------------|
| Nutrients : | Levels : |
| 1. Zinc | 1. 0.25% spray |
| 2. Copper | 2. 0.50% .. |
| 3. Manganese | 3. 1.00% .. |
| 4. Boron | |
- The treated leaves will be analysed to assess the extent of absorption. In addition to recording of data on growth and yield, the quality will also be assessed (oleoresin content). The incidence of disease will be scored.
- The experiment will also be conducted in cultivators' fields adopting the level of 0.50% spray of all micronutrients. The locations will be in the SADU units at 3 locations in each district of Cannanore, Idukki and Kottayam.
- 10 Date of start : July 1978
- 11 Likely date of completion : July 1985
- 12 Estimated man months : 84
- 13 Facilities required : Existing facilities are sufficient
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost (Per year) :
- | | |
|------------------|-------------------|
| a. Pay of staff | Rs 7,500 |
| b. Equipments | nil |
| c. Contingencies | Rs. 7,500 |
| Total per year | Rs. <u>15,000</u> |

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5 (a) 19.5
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on pepper
Title of the problem : Standardization of tissue analysis technique in pepper
- 5 Name and designation of the Principal Investigator : P. A. Wahid, Assoc. professor
- 6 Name (s) and designation of Associate (s) : S. Balakrishnan, Professor of Horticulture (Pepper)
- 7 Location : University Main Campus, Vellanikkara
- 8 a) Objectives : To standardise the tissue analysis technique for pepper for wide scale adoption for manurial recommendations
- b) Practical utility : Tissue analysis is an important tool for the correct diagnosis of the nutrient status of the plant. Therefore, standardisation of this method is absolutely necessary for fertilizer recommendation which is an important input in production.
- 9 Technical programme : 1. Field Survey:
The leaf from different yield groups will be analysed. The total and available nutrients in the soil and the nutrient content of the leaves and petioles will also be determined.
2. Yield of different age groups:
The materials collected from different treatments of the fertilizer trials will also be analysed for NPK, Ca and Mg.
10. Date of start : September 1978
11. Likely date of completion : September 1981
12. Estimated man months : 36
13. Facilities required : The facilities available at the College of Horticulture and KADP will be utilised
14. Financing organisation : KADP Research and Training
15. Approximate cost (per year) :
- | | |
|------------------|-------------------|
| a. Pay of staff | Rs. 7,500 |
| b. Equipments | ... |
| c. Contingencies | Rs. 3,000 |
| Total | Rs. <u>10,500</u> |

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PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : AG. 5. (a) 19.6
2. ICAR Code No. :
- 3 Name and address of the Institute / Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on pepper
Title of the problem : Biology, phenology, and bionomics of the pepper pollu beetle, *Longitarsus nigripennis*.
- 5 Name and designation of Principal Investigator :
- 6 Name (s) and designation of Associate (s) :
- 7 Location : College of Horticulture, Vellanikkara
- 8 a) Objectives : To study the biology and bionomics and seasonal history of the pest in Kerala and to identify the weaker link stages in the life history which are vulnerable to cultural/chemical control methods.
- 9 Technical programme : Adult beetles will be obtained from the Pepper Research Station, Panniyur during August-Sept. and pairs will be confined in micro-cages enveloping half ripe spikes to induce oviposition. The duration of different instars and the morphology of different stages will be studied under lab conditions by incubating field collected eggs at $28 \pm 1^\circ\text{C}$ in poly containers having a layer of moist earth at bottom.
1. The phenology of the pest will be recorded at the Pepper Research Station, Panniyur and in a few pepper plantations in the vicinity by recording at fortnightly intervals the % of infection
2. In the off blossom season soil samples will be collected from the infested garden and the population of pupae recorded.
- After studying the biology at $28 \pm 1^\circ\text{C}$ the insect will be reared at various temperature - humidity combinations to ascertain the influence of abiotic factors on population dynamics.
- 10 Date of start : 1979
- 11 Likely date of completion : 1983
- 12 Estimated man months :
- 13 Facilities required : Insectory facilities in the Dept. of Entomology will be utilised
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost :

(Sd)

PRINCIPAL INVESTIGATOR

1	Institute Code No.	:	AG. 5 (a) 19. 7	
2	ICAR Code No.	:		
3	Name and address of the Research Institute/Centre	:	College of Horticulture, Vellanikkara.	
4	Title of the project	:	Research on pepper	
	Title of the problem	:	Role of nematodes on the incidence of slow wilt disease of pepper and to find suitable control measures	
5	Name and designation of Principal Investigator	:	K. K. Ravindran Nair, Assistant Professor (Nematology)	
6	Name (s) and designation of Associate(s)	:	S. Balakrishnan, Professor of Horticulture (Pepper)	
7	Location	:	Kerala Agricultural University, Vellanikkara.	
8 a)	Objectives	:	To find out the exact role of plant parasitic nematodes, <i>Radopholus similis</i> and <i>Meloidogyne incognita</i> on the slow wilt complex of pepper and to find out suitable control measures.	
	b) Practical utility	:	The information helps in understanding the etiology of the disease and to find out suitable control measures.	
9	Technical programme	:	a. Periodic and systematic survey of slow wilt affected pepper gardens for the collection of stratified samples of soils and root of pepper to find out the association of parasitic nematodes b. Establishing the pathogenicity of nematodes on pepper by artificial inoculation. c. Adoption of an integrated control measure for the disease.	
10	Date of start	:	August 1978	
11	Likely date of completion	:	1983	
12	Estimated man months	:	120	
13	Facilities required	:	Stereo microscope—1 No.	
14	Financing organisation	:	KADP Research and Training	
15	Approximate cost	:	a. Staff	Rs. 84,000
			b. Equipments	Rs. 12,000
			c. Contingencies	Rs. 10,000
			Total	<u>Rs. 1,06,000</u>

(Sd)

PRINCIPAL INVESTIGATOR

Institute Code No. : KADP. AG 5. (a) 19.8

Studies on the Fungal Pollu.

- a. The etiology and nature and extent of damage due to this disease should be studied as no work has been done in this line.
- b. The ecological factors like the atmospheric temperature, relative humidity, rainfall and the stage of the crop when the new infection comes require a detailed study for taking suitable control measures.
- c. Estimate the loss due to the disease in the plots where the quick wilt disease control measures were received. This finding will help us to know whether separate control measures for the disease is warranted, apart from the prophylactic sprays which we usually give for controlling the quick wilt disease.

Institute Code No. : KADP. AG. 5 (a) 19.9

Ecological studies on Quick wilt disease.

- a. The temperature, relative humidity, rainfall, sunshine, the stage of the host, the soil condition (soil temperature and moisture) should be worked out in detail to know which are the conditions favourable for new infection and its outbreak and development. The study is not carried out anywhere and it will help to forecast the outbreak of the disease as well as to take timely control measures for the disease.
- b. Find out the host range of the pathogen especially the weeds and other vascular plants usually seen in Kerala pepper gardens. This study will help to minimise the primary infection sources by eradicating the unwanted collateral hosts of the pathogen from the pepper gardens.
- c. Development of quick wilt symptoms under lab. conditions. Inoculation test will be conducted to produce quick wilt symptoms by inoculating *Phytophthora* with a view to identify the incidence of the disease even in the early stage.

- 1 Institute Code No. : KADP. AG. 8 (c) 19.1
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cocoa.
- Title of the problem : Propagational studies on cocoa.
- i) To fix up the criteria for mother plant selection
- ii) To fix up the criteria for seedling selection
- iii) To standardise the vegetative propagation methods.
- 5 Name and designation of Principal Investigator : Dr. N. Mohanakumaran, Professor of Horticulture (Cocoa)
- 6 Name(s) and designation of Associate(s) : Dr. P. C. S. Nair, Associate Dean.
- 7 Location : KAU Main Campus, Vellanikkara.
- Mother plants will be selected from reputed gardens (including cultivators' fields).
- 8 a. Objectives :
- i) To standardise the procedure for mother plant selection and to isolate genetically superior plants.
- ii) To mark out the characters for seedling selection and
- iii) To standardise the vegetative propagation method/methods.
- b. Practical utility :
- The present system of indiscriminate collection of cocoa pods from the harvested lot and raising seedling progeny from them will result in a large proportion of trees yielding little or nothing. This method will be replaced by scientific selection of mother plants and choosing the pods from the selected plants. Progeny raised by this procedure will be expected to perform better. This will increase the yielding potential of plants and ultimately the production of cocoa in our state. Standardisation of vegetative propagation method/methods will help to raise clonal populations from selected high yielding, disease resistant, genetically superior plants. Uniform high yield can be expected from such progeny.
- 9 Technical programme :
- i. To fix up criteria for mother plant selection.
Plants will be selected from cultivators' field and KAU research stations based on their age, flowering, percentage set, number of pods borne per plant per year, consistency or regularity in production, pod value/pod index (i. e. pods required to produce one pound of dry beans), number of seeds/pod, bean size, bean quality, resistance to diseases, pests, etc, freedom from abnormalities etc, Progeny will be raised from these and based on the performance of the progeny, criteria will be fixed for mother plant selection.
- ii To fix up criteria for selecting fruits, seeds and seedlings.
The fruits will be harvested from December to May at monthly

intervals and they will be classified into small, medium and big. The seeds will be extracted and classified into three groups depending upon the position of the seed in the fruit; i. e., pedicel end (1/3), distal end (1/3) and centre (1/3).

The following observations will be made:

- 1 Size of the fruit
- 2 Volume of the fruit
- 3 Seeds under each class
- 4 Size of the seeds

The progeny will be raised and the following data will be recorded.

- 5 Germination percentage
- 6 Shoot and root growth at intervals
- 7 Leaves produced
- 8 Size of leaves
- 9 Frequency of leaf production
- 10 Survival of the plants during the first year
- 11 Age at flowering
- 12 Percentage set
- 13 Number of pods/plant/year
- 14 Pod value/pod index
- 15 Number of seeds per pod
- 16 Bean size
- 17 Bean quality
- 18 Resistance to diseases and pests.

- iii To standardise the vegetative propagation method/methods. Rooted cuttings will be raised of chupons and fan shoots with and without plant growth substances.

Treatments:

- T1 - Control
T2 to T5 - IAA 4 concentrations
T6 to T10 - IBA 4 concentrations
T11 to T15 - NAA 4 concentrations
T16 to T20 - Bioten 4 concentrations

Percentage rooting, establishment and the growth pattern of the resulting progeny will be studied, apart from the production capacity.

Shield budding, patch budding and forkert methods will also be tried. The progeny will be evaluated for percentage take, growth, establishment and production capacity.

Air layering of shoots will also be tried.

- 10 Date of start : December 1977—December 1978
- 11 Likely date of completion : 1985 (If necessary, the studies will be extended for a further period of five years)
- 12^o Estimated man months : 64

13	Facilities required	:	Existing facilities at the College of Horticulture and KADP.								
14	Financing organisation	:	KADP Research and Training.								
15	Approximate cost	:	<table> <tr> <td>a. Staff</td> <td>Rs. 70,000</td> </tr> <tr> <td>b. Equipments</td> <td>...</td> </tr> <tr> <td>c. Contingencies</td> <td><u>Rs. 40,000</u></td> </tr> <tr> <td>Total (for five years)</td> <td><u><u>Rs. 1,10,000</u></u></td> </tr> </table>	a. Staff	Rs. 70,000	b. Equipments	...	c. Contingencies	<u>Rs. 40,000</u>	Total (for five years)	<u><u>Rs. 1,10,000</u></u>
a. Staff	Rs. 70,000										
b. Equipments	...										
c. Contingencies	<u>Rs. 40,000</u>										
Total (for five years)	<u><u>Rs. 1,10,000</u></u>										

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 8 (c) 19.2
2. ICAR Code No. :
3. Name and address of the Res. Institute/Centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on cocoa.
- Title of the problem : Trials on training and pruning of cocoa.
5. Name and designation of Principal Investigator : Dr. N. Mohanakumaran, Professor of Horticulture (Cocoa).
6. Name (s) and designation of Associate(s) : Dr. P. C. Sivaraman Nair, Associate Dean.
: Dr. K. Kumaran, Associate Professor (Botany)
7. Location : College of Horticulture, Vellanikkara and also District Agricultural Farms and cultivators' fields to be selected.
8. a) Objectives : To standardise the training and pruning method for cocoa under Kerala conditions.
- b) Practical utility : Proper training and pruning is absolutely necessary for cocoa for optimum growth and economic production. The nature of training necessary and the extent of pruning required vary from place to place depending upon the growing conditions. Standardisation of these practices under Kerala conditions will help to increase the production of cocoa in our state.
9. Technical programme : The following treatments will be adopted.
- Design : RBD
Treatments : 7
Replications : 4
No. of plants/treatment/replication : 6
Total number of plants : 168
- Treatments :
1. Training to 1 - 1.5m height and developing a single tier and prune the remaining.
 2. Training to 1.5 - 2.0m -do-
 3. Training to 2.0 - 2.5m -do-
 4. Training to 1.0 - 1.5m height and develop a second tier 1.0-1.5m above the first.
 5. Same as in 2 and the second tier 1.0-1.5m above the first.
 6. Same as in 3 and the second tier 1.0 to 1.5m above the first.
 7. Control (without pruning)

This will be tried under three conditions; under intercropped conditions in coconut, arecanut and as pure crop.

10. Date of start	:	December 1978	
11. Likely date of completion	:	December 1985 (If necessary, the studies will be extended for a further period of five years).	
12. Estimated man months	:	32	
13. Facilities required	:	KADP facilities	
14. Financing organisation	:	KADP Research and Training.	
15. Approximate cost	:	a. Staff	Rs. 70,000
		b. Equipments	
		c. Contingencies	Rs. 10 000
		Total (for five years)	<u>Rs. 80.000</u>

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 8 (c) 19.3
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cocoa.
 Title of the problem : Nutritional studies on cocoa.
 a. To find out the optimum requirements of NPK, Ca and Mg of cocoa.
 b. To find out the effect of Zn on the growth and production of cocoa.
 c. Standardisation of leaf analysis technique for cocoa.
- 5 Name and designation of Principal Investigator : Dr. N. Mohanakumaran, Professor of Horticulture (Cocoa)
- 6 Name(s) and designation of Associate (s) : Marykutty, Assistant Professor (Agrl. Chemistry)
 P. A. Wahid, Associate Professor
 Dr. A. I. Jose, Associate Professor (Agrl. Chemistry)
- 7 Location : KAU Main Campus, Vellanikkara & Cultivators' fields in Trivandrum Cannanore, Kozhikode and Malappuram districts.
- 8 a. Objectives : To study the optimum requirements of nutrients for maximum production of cocoa under inter-cropped conditions and also to evolve a suitable leaf analysis standard for large scale adoption for deciding the manurial requirements. The optimum requirements of Zn will also be studied.
- b. Practical utility : The studies will help provide manurial recommendations for cocoa cultivation under the different agro-climatic conditions of Kerala replacing the present general recommendations of 100 g. N, 40 g. P₂O₅ and 140 g. K₂O/plant/year.
- 9 Technical programme : (a) **To find out the optimum requirements of NPK, Ca and Mg.**
 Simple fertilizer trial with the following treatments will be conducted in the cultivators' fields.
- | Treatments | N | P ₂ O ₅ | K ₂ O | CaO | MgO |
|------------|--|-------------------------------|------------------|-----|-----|
| | | | (gm./plant/year) | | |
| T1 | 50 | 20 | 70 | 15 | 15 |
| T2 | 100 | 40 | 140 | 30 | 30 |
| T3 | 200 | 80 | 280 | 60 | 60 |
| T4 | 250 | 100 | 350 | 75 | 75 |
| T5 | Compost or cattle manure @ 15 kg. per plant. | | | | |
- The above doses will be given according to the bearing of the plants in two split doses.
- Design : RBD
 Treatments : 5
 Replications : 5
 No. of plants per treatment/replication : 4
 Total experimental plants : 80

Observations to be recorded :

- a. Growth
- b. Flowering
- c. % fruit set
- d. No. of fruits harvested
- e. Nutrient content of leaves
- f. Nutrient content of the soil, both total and available,

(b) To find out the effect of Zn.

- T 1 Soil application 25g/ plant/ year
 - T 2 Soil application 15g/ plant/ year
 - T 3 Spray 0.5%
 - T 4 Spray 1.0%
 - T 5 Control (without Zn)
- } Once in an year.

Design : RBD

Treatments : 5

Replications : 3

Number of plants/treatment/replication. : 5

Total number of plants : 90

All the plants will be given 100 g. N, 40 g. P_2O_5 and 140 g. K_2O uniformly in addition to the treatments mentioned earlier.

The uptake of Zn will be estimated by leaf analysis.

(c) Standardisation of leaf analysis technique.

Leaves will be analysed from different yield groups and the optimum, excess and deficient range of NPK, Ca, Mg and Zn will be determined.

- 10 Date of start : September-October 1978
- 11 Likely date of completion : 1982 (After conclusion of these studies, a fresh long-term experiment will be started based on the findings).
- 12 Estimated man months : 56
- 13 Facilities required : KADP facilities and facilities in the Agrl. Chemistry section, College of Horticulture.
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost :

a. Staff	Rs. 65,000
b. Equipments	.....
c. Contingencies	Rs. 30,000
Total	Rs. 95 000
(for five years)	

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 8 (c) 19.4
2. ICAR Code No. :
3. Name and address of the Research Institute/Centre : College of Horticulture Vellanikkara.
4. Title of the project : Research on cocoa
Title of the problem : Studies to determine the optimum shade requirement for cocoa.
5. Name and designation of Principal Investigator : Dr. N. Mohanakumaran, Professor of Horticulture (cocoa),
6. Name(s) and designation of Associate (s) : Dr. R. Vikraman Nair, Assoc. Prof. (Agronomy)
7. Location : KAU Main Campus, Vellanikkara.
8. a) Objectives : To ascertain the optimum shade requirements for cocoa for maximum production and economical life span under Kerala conditions.
- b) Practical utility : While growing cocoa as an intercrop, the optimum shade is an important factor affecting yield, life of the plant and pest and disease incidence. Hence, this has to be correctly assessed for large scale adoption.
9. Technical programme : Gardens with different light intensities will be selected. The light intensity will be measured at frequent intervals for a period of three years to find out the optimum shade requirements.
The data on growth, flowering, fruit set, yield, and pests and disease incidence will be recorded. The nutrient status of leaves under different light intensities will also be assessed.
Uniform cultural, manurial practices and irrigation will be provided
10. Date of start : September-October 1978
11. Likely date of completion : June 1985
12. Estimated man months : 35
13. Facilities required : KADP facilities and facilities of the College of Horticulture, Vellanikkara.
14. Financing organisation : KADP Research and Training
15. Approximate cost : a. Staff Rs. 55,000
b. Equipments ..
c. Contingencies Rs. 15,000
Total (for five years) Rs. 70,000

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. (c). 19.5
- 2 ICAR Code No. :
- 3 Name and address of the Res. Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cocoa
Title of the problem : Control of insect pests of cocoa
- 5 Name and designation of Principal Investigator : Dr. D. Dale, Assoc. Professor (Entomology)
- 6 Name(s) and designation of Associate(s) : 1) Dr. C. C. Abraham, Professor of Entomology.
2) G. Madhavan Nair, Asst. Professor (Entomology.)
- 7 Location of research project : KAU Main Campus, Vellanikkara
- 8 a) Objectives : Over 1500 different insects are known to feed on cocoa. However, only about 20 pests are of economic significance in Kerala. Of these, the red borer *Zeuzera coffeae* and the stem girdler *Sthenias grisator* causes substantial damage by boring into the shoots and main stems of the plant. As the cocoa cultivation is becoming more and more intensive and the area under cocoa is increasing year after year in Kerala, it is likely that the pest problems in future may become more acute. No trials for the control of insect pests of cocoa have so far been undertaken in our state. Hence the project is aimed at evolving suitable prophylactic/control measures against the insect pests of cocoa.
- b) Practical utility : The results of the project are expected to throw light on the best insecticidal treatment, time of application and duration of treatment needed to keep the cocoa pests under check.
- 9 Technical programme : The experiment will be laid out in KAU plantations at Kannara. A group of ten plants will form a treatment. All the treatments will be replicated thrice. Untreated control plots will be kept as check. The following monthly treatments will be done.
- | | |
|-----------------|-------|
| 1. Ekalux | 0.05% |
| 2. Dimethoate | 0.05% |
| 3. Carbaryl | 0.10% |
| 4. Fenvalerate | 0.03% |
| 5. BHC | 0.15% |
| 6. Fenitrothion | 0.15% |
| 7. Phosalone | 0.10% |
- Pre and post-treatment counts of insects and damage ratings for different insects as scores will be recorded and the data will be subjected to statistical analysis. The population fluctuations of insect pollinators will also be monitored to ascertain the effect of insecticides. In another experiment the relative curative efficiency of fumigants against stem borers applied as injections through bore holes will be evaluated. For this, paradichlorobenzene, petrol and kerosine will be tried. Recovery of plants and

phytotoxaemia caused by fumigants will be recorded. This experiment will be conducted wherever serious field infestations are reported.

- 10 Date of start :
11 Likely date of completion : December 1979
12 Estimated man months :
13 Facilities required : Facilities available in the Department of Entomology will be utilised.
14 Financing organisation : KADP Research and Training
15 Approximate cost : Rs. 2,000/-

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PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 8 (c) 19.6
- 2 ICAR Code No. :
- 3 Name and address of the Institute / Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cocoa
Title of the problem : Studies on the management of squirrels infesting cocoa pods
- 5 Name and designation of Principal Investigator :
- 6 Name (s) and designation of Associate (s) :
- 7 Location : KAU Main Campus, Vellanikkara.
- 8 a. Objectives : The striped squirrel (*Funambulus tristriatus tristriatus*) is a major pest of cocoa pods in Kerala often covering 20-50% damage. The objective is to develop suitable techniques for protecting the pods from the striped squirrels.
- b. Practical utility : Effective protection of pods from squirrels' damage will substantially increase production in plantation which are now badly infested with the squirrels.
- 9 Technical programme : Repellants such as neem oil emulsion, fish oil soap etc. will be tried on spot applications on bronzing pods in graded concentrations and then relative efficiency monitored by recording the percentage of pods damaged.
- 10 Date of start : 1979
- 11 Likely date of completion : 1981
- 12 Estimated man months :
- 13 Facilities required : Private plantations are required for the conduct of the trial
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost : Rs. 1000/-

(Sd)

PRINCIPAL INVESTIGATOR



- 1 Institute Code No. : KADP. AG. 8 (c) 19.7
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cocoa
Title of the problem : Investigations on the etiology of the fruit drop disease and their control
- 5 Name and designation of the Principal Investigator : Assistant Professor (Plant Pathology)
- 6 Name(s) and designation of the Associate(s) :
- 7 Location : KAU Main Campus, Vellanikkara
- 8 a. Objectives : 1. Fruit drop in cocoa is caused by physiologic disorders and by pathogenic microflora. The main object of this investigation is to find out the role of microorganism in the fruit drop of cocoa
2. To conduct detailed investigation on fruit drop of cocoa caused by *phytophthora*.
- b. Practical utility : The findings of this experiment will help to suggest suitable control measures against microbial fruit drop of cocoa.
- 9 Technical programme : 1. Three cocoa tracts in Kerala namely Wynad, Peechi and Kottayam will be selected for the investigation of fruit drop. The dried and dropped fruits will be collected at monthly intervals and the microorganism associated with it will be identified. Koch's postulate studies will be conducted to establish pathogenicity of the microorganism.
2. Three isolated cocoa gardens where the disease *Phytophthora* had been appearing continuously for the last few years will be selected for the experiment. All the important agro-climatic factors of this area will be recorded and the spread of the disease will also be estimated during this period. Laboratory studies will be conducted to study the most suitable condition for the disease development. From there a correlation will be worked out.
- 10 Date of start : June 1979
- 11 Likely date of completion : September 1984
- 12 Estimated man months : 40
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training.
- 15 Approximate cost : Rs. 1,00,000/

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 8 (c) 19.8
- 2 ICAR Code No. :
- 3 Name and address of the Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on cocoa
Title of the problem : Control measures for pink disease (*Corticium salmonicolor*).
- 5 Name and designation of the Principal Investigator : Assistant Professor (Plant Pathology)
- 6 Name(s) and designation of Associate (s) :
- 7 Location : KAU Main Campus, Vellanikkara
- 8 a) Objectives : Pink disease is one of the important and widespread diseases of plantation crops including cocoa. The main objective of this study is to find out suitable control measures against pink disease.
- b) Practical utility : The findings of this experiment will be of great practical utility to the cocoa growers of India in checking pink disease.
- 9 Technical programme : 1 Remove all dried twigs and branches before the onset of monsoon and apply wood dresser.
2 Apply Bordeaux paste at the fork region and spray 1% B. M. before the onset of monsoon + treatment No. 1.
3 — Do—use thiride
4 — Do—use black Bordeaux
5 — Do—use Systemic fungicide (Benlate)
Treatments 2, 3, 4, and 5 will be given immediately after the first visible symptom of the disease is noticed.
- 10 Date of start : June 1979
- 11 Likely date of completion : August 1982
- 12 Estimated man months : 12 months
- 13 Facilities required : Staff as per approved project
- 14 Financial organisation : KADP Research & Training
- 15 Approximate cost : Rs. 15,000/

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 8 (c) 19.10
- 2 ICAR Code No. :
- 3 Name and address of the Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on cocoa
 Title of the problem : Post harvest microbial deterioration of cocoa
- 5 Name and designation of Principal Investigator : Assistant Professor (Plant Pathology)
- 6 Name (s) and designation of Associate (s) :
- 7 Location : KAU Main Campus, Vellanikkara.
- 8 a) Objectives : To study the micro organisms associated with Cocoa p cds, their variation of occurrence in different seasons and their role in deterioration of cocoa during storage.
 b) Practical utility : The study will reveal how pods of cocoa and beans are degraded by the micro organisms in the different seasons of the year.
- 9 Technical programme : 1 Periodical collection of pods fom three cocoa producing centres and assessment of the microflora associated with it.
 2 Assessment of microflora associated with cocoa beans at periodical intervals.
 3 Isolation and identification of the organisms associated with pods and beans.
 4 Assessment of the role of each micro organism in changing the quality of the product in different humidity and temperature conditions.
- 10 Date of start : August 1979
- 11 Likely date of completion : August 1982
- 12 Estimated man months : 15 months
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost (Per year) : Rs. 12,000/-

(Sd)

PRINCPAL INVSTIGATOR

- 1 Institute Code No. : KADP. AG. 8 (c) 19.9
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture. Vellanikkara,
- 4 Title of the project : Research on cocoa
 Title of the problem : Studies on the die back disease of cocoa – causes and control.
- 5 Name and designation of the Principal Investigator : Assistant Professor (Plant Pathology)
- 6 Name (s) and designation of the associate (s) :
- 7 Location : KAU Main campus, Vellanikkara
- 8 a.) Objectives : Die back is a common disease of plantation crops including cocoa. The objective of this study is to find out the role of different micro organisms associated with the disease.
- b.) Practical utility : The findings will help to suggest suitable control measures against the disease.
- 9 Technical programme : 1 Isolate all the organisms associated with die back of cocoa plants.
 2 Establish Koch's postulates
 3 Remove all dried up portions and apply wound dressers
 4 Do + spray Bordeaux mixture
 5 Do + „ Systemic fungicide (Benlate)
 6 Do + „ Carbamate fungicide (Thiride)
- Treatments 3, 4, 5 and 6 will be done immediately after the symptoms of die back are noticed.
- 10 Date of start : May 1980
- 11 Likely date of completion : August 1983
- 12 Estimated man months : 12 months
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost (per year) :

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6. 19.1
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute / Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on cashew
Title of the problem : Survey and collection of superior genotypes
- 5 Name and designation of Principal Investigator : V. K. Damodaran,
: Professor of Horticulture (Cashew)
- 6 Name(s) and designation of Associate(s) : K. K. Vidyadharan,
: Assoc. Professor (Botany)
- 7 Location : KAU Main Campus, Vellanikkara.
- 8 a) Objectives : To find out the high yielding plants by survey of the existing plantations and to develop high yielding varieties for large scale multiplication.
- b) Practical utility : The identification of superior genotypes will make a significant contribution in increasing the production of cashewnut in the state.
- 9 Technical programme : The major cashew growing areas will be surveyed and high yielding trees will be selected. The selected trees will be vegetatively propagated and their performance will be studied in different locations. In addition to the yield, the flowering, fruiting, nut characters and disease and pest incidence will be considered in selection.
- 10 Date of start : April, 1978
- 11 Likely date of completion : June, 1985
- 12 Estimated man months : 84
- 13 Facilities required : Staff as per the approved project
- 14 Financing organisation : KADP – Research and Training
- 15 Approximate cost :
a) Pay etc. of staff : Rs. 1,98,000
b) Equipments :
c) Contingencies : Rs. 1,00,000/-
Total (for 5 years) : Rs. 2,98,000

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP AG. 6. 19. 2
2. ICAR Code No. :
3. Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara,
4. Title of the Project : Research on cashew
Title of the problem : Genetic improvement by hybridisation and selection
5. Name and designation of Principal Investigator : V. K. Damodaran, Professor of Horticulture (Cashew)
6. Name (s) and designation of Associate (s) : K. K. Vidyadharan, Associated Professor (Botany)
7. Location : KAU Main Campus, Vellanikkara.
8. a.) Objectives : To evolve high yielding disease resistant or tolerant varieties suitable for different agro-climatic conditions by hybridisation and selection.
b.) Practical utility : Evolution of better varieties by breeding will increase the yield of new plantings and replanting programmes.
9. Technical programme : 300 hybrids produced by the KAU will be planted and detailed study of the plant performance will be conducted and desirable types will be selected and multiplied vegetatively. New desirable parents will also be included in the hybridisation programme. The plants will be screened against natural incidences of disease and pests.
10. Date of start : June 1978
11. Likely date of completion : January 1985
12. Estimated man months : 84 man months
13. Facilities required : Staff as per the approved project
14. Approximate cost :
Pay of staff : Included in the previous project
Equipments : Listed separately
Contingencies : Rs. 15,000/- (for one year)

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6. 19. 3
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara.
- 4 a. Title of the project : Research on cashew
b. Title of the problem : Standardisation of vegetative propagation in cashew
- 5 Name and designation of Principal Investigator : V. K. Damodaran, Professor of Horticulture (Cashew)
- 6 Name (s) and designation of associates (s) : P. K. Valsalakumari
- 7 Location : KAU Main Campus, Vellanikkara
- 8 a. Objectives : To standardise vegetative propagation in cashew
b. Practical utility : Cashew, being highly heterozygous and cross pollinated in nature there is much variation in seedling population. Therefore by providing vegetatively propagated planting materials, the yield can be increased.
- 9 Technical programme : The following methods will be tried and their survival in the main field will be tested.
- | | |
|---|-----------------------|
| 1 Layering | 2 Patch budding |
| 3 Shield budding | 4 Veneer grafting |
| 5 Stem cuttings under controlled conditions | 6 By meristem culture |
- 10 Date of start : May 1978
- 11 Likely date of completion : May 1981
- 12 Estimated man months. : 36 (for 3 years)
- 13 Facilities required : Staff as per the approved project
- 14 Financing organisation : KADP – Research and Training
- 15 Approximate cost :
- Pay of staff : No additional staff for this project
- Equipments : Listed separately
- Contingencies : Rs. 15,000/- (for one year)

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6. 19. 4
- 2 ICAR Code No. :
- 3 Name and address of research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cashew
Title of the problem : Nutritional studies on cashew
- 5 Name and designation of the Principal Investigator : V. K. Damodaran.
Professor of Horticulture (Cashew)
- 6 Name(s) and designation of Associate(s) : C. Marykutty, Asst. Professor (Chemistry.)
- 7 Location : KAU Main Campus, Vellanikkara and cultivators' fields
- 8 a. Objectives : To find out a manurial schedule for laterite and sandy soils
b. Practical utility : To increase the yield and quality by proper manuring
- 9 Techn.cal programme : The following manuring schedule will be adopted for yielding plants.
- | N | P ₂ O ₅
(gm/plot/year) | K ₂ O |
|------|---|------------------|
| 250 | 125 | 250 |
| 500 | 250 | 500 |
| 1000 | 500 | 1000 |
- Design: Factorial. Separate trials will be laid out for sandy and laterite soils. The leaf and soil will be analysed at fixed intervals. The flowering, fruiting, and incidence of pests and diseases will be recorded.
- 10 Date of start : May 1978
- 11 Likely date of completion : June 1983
- 12 Estimated man months : 120
- 13 Facilities required : Staff as per the approved project
- 14 Financing organisation : KADP - Research & Training
- 15 Approximate cost
Pay etc. of staff : Rs. 12,000/- for the Assistant Professor
Equipments : Listed separately
Contingencies : Rs. 15,000/- (one year)

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6-19.5
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cashew
Title of the problem : Multi location trials on orchard management practices-intercropping.
- 5 Name and designation of Principal Investigator : V. K. Damodaran, Professor of Horticulture (Cashew)
- 6 Name(s) and designation of Associate(s) : P. K. Rajeevan, Instructor (Horticulture)
- 7 Location : KAU Main Campus and cultivators' fields
- 8 a. Objectives : To assess the best economical intercrops for cashew for first four years.
- b. Practical utility : Best method of management will increase the production of cashew.
- 9 Technical programme : To assess the best and economical intercrops
- Treatments
- 1 Growing lemongrass
 - 2 Growing tapioca
 - 3 Growing cowpea followed by horse gram
 - 4 No cultivation (only sickle weeding)
- Design : R B D
- Treatments : 4
- Replications : 5
- No. of plants/treatment/replication : 6
- Total no. of plants : 120
- 10 Date of start : June 1978
- 11 Likely date of completion : May 1983
- 12 Estimated man months : 60 for 5 years
- 13 Facilities required : Staff as per the approved project
- 14 Financing organisation : KADP - Research & Training
- 15 Approximate cost : Rs. 10,000/- (Contingencies.)

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6. 19. 6
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cashew
Title of the problem : Cultural trial
- 5 Name and designation of Principal Investigator : V. K. Damodaran, Professor of Horticulture (Cashew)
- 6 Name(s) and designation of Associate(s) : P. K. Valsalakumari
- 7 Location : KAU Main Campus and cultivators' fields
- 8 a) Objectives : To determine the best orchard management practices for cashew
b) Practical utility : At present no cultural practices are adopted in cashew gardens and no research work has been done so far on these aspects. The proposed study will enable to recommend the best orchard management practices for cashew and thereby contribute to enhance the production of cashewnut.
- 9 Technical programme : Treatments:
1. Control-sickle weeding once
2. Light digging around the plant over a radius of 2 metres
3. Light digging as above + mulching at 2 metres
4. Mulching over 1 metre radius
5. Cover-cropping
- Design : RBD
Treatments : 5
Replications : 4
No. of trees per plot : 6 (Total - 120 plants)
- 10 Date of start : June, 1978
- 11 Likely date of completion : June, 1983
- 12 Estimated man months : 60
- 13 Facilities required : Staff as per the approved project
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost : Contingencies: Rs. 5,000 per year

(Sd)
PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5. 19. 7
- 2 ICAR Code No. :
- 3 Name and address of the Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on Cashew
Title of the problem : Spacing trial
- 5 Name and designation of the Principal Investigator : V. K. Damodaran,
Professor of Horticulture (Cashew)
- 6 Name(s) and designation of the Associate (s) : P. K. Rajeevan, Instructor (Horticulture)
- 7 Location : KAU Main Campus, Vellanikkara
- 8 a. Objectives : To determine the optimum spacing for seedling plants and air layered plants
- b. Practical utility : Proper spacing in cashew gardens is very important for cashewnut production. No research results on the aspect are now available. The proposed study will enable to make definite recommendation to the growers on this important aspect.
- 9 Technical programme : Treatments:
- (1) 4m × 4m 4m within row × 4m between rows
- (2) 4m × 8m 4m " 8 "
- (3) 4m × 8m Remove one tree within each row after the canopy touches - to get a spacing of 8 × 8
- (4) 4m × 12m 4m within row and 12m between rows
- (5) 4m × 12m Remove one tree within row when canopy touches to get a spacing of 8m × 12m
- (6) 4m × 12m Remove two trees within rows in two stages when the canopy touches to get a final spacing of 12 × 12
- (7) 8m × 8m
- Design : RBD
- Replications : 3
- Treatments : 7
- No. of plants : 8 per plot except treatment No. 7 which will have only 4 plants per plot
- 10 Date of start : June 1978
- 11 Likely date of completion : June 1985
- 12 Estimated man months : 84
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost : Contingencies: Rs. 8000/-per year

(Sd)
PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. (6) 19.8
- 2 ICAR Code No. :
- 3 Name and address of the Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cashew
Title of the problem : Exploration of the feasibility of the biological control of *Helopeltis antonii*.
- 5 Name and designation of Principal Investigator :
- 6 Name (s) and designation of Associate (s) :
- 7 Location : Cashew Research Station, Vellanikkara
- 8 a. Objectives : To explore the feasibility of biological control of *Helopeltis antonii* using parasites/predators/microbial pathogens.
b. Practical utility : The tea mosquito *Helopeltis antonii* is the most serious pest of cashew in Kerala and the pest occurs in overlapping generations. Therefore frequent insecticidal applications become essential. This increases the cost of production and leads to environmental pollution and decline in the population of parasites. Biological control if found feasible will be ideal against *Helopeltis* and hence the project is proposed
- 9 Technical programme : Survey will be conducted periodically on the insect parasites, predators and pathogens associated with stages of *Helopeltis*. In each case the efficiency of the natural enemy will be evaluated by the predatory potential/extent of parasitism/infectivity and virulence. The amenability to lab rearing of the promising bio-control agent will be studied and biological suppression techniques developed.
Exotic biocontrol agents will be imported through the CIBC from Sri Lanka or other areas and their adaptability and utility will be evaluated.
10. Date of start :
11. Likely date of completion : 3 years after the start
12. Estimated man months :
13. Facilities required : Existing facilities will be utilised
14. Financing organisation : KADP – Research and Training
15. Approximate cost :

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6 19. 9
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cashew
Title of the problem : Studies on the control of stem borer (*Plocaederus ferrugineus*)
- 5 Name and designation of :
Principal Investigator
- 6 Name(s) and designation of Associate(s) :
- 7 Location : Cashew Research Station, Anakkayam and part of Malappuram district where the pest is endemic
- 8 a. Objectives : To devise satisfactory prophylactic and control methods against the pest
b. Practical utility : *Plocaederus* is a deadly enemy of cashew trees and a suitable combination of prophylactic and curative management practices would be essential for the protection of trees.
- 9 Technical programme : a. Application of DP formulations of HCH, phosalone, carbaryl, and aldrin around the base of trees and scrubbing the main trunk with suspension of WP formulation of these toxicants will be evaluated as prophylactic treatments against the pest.
b. An attempt will be made to rear the insect in confinement on excised stems of cashew/mango
c. Subject to amenability to lab rearing, the contact toxicity of relatively non hazardous pesticides will be evaluated in the laboratory.
d. The curative efficiency of solid and liquid fumigants such as Al. Phosphide, EDB, petrol etc. will be evaluated in trees showing severe infestation.
- 10 Date of start : 1979
- 11 Likely date of completion : 1982
- 12 Estimated man months :
- 13 Facilities required :
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost : Rs. 5000/-

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 6. 19.10
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara
- 4 Title of the project : Research on cashew
Title of the problem : Studies on the relative susceptibility of different genotypes of cashew to the infestation of tea mosquito
- 5 Name and designation of the Principal Investigator :
- 6 Name(s) and designation of Associate (s) :
- 7 Location : Cashew Research Station, Vellanikkara
- 8 a) Objectives : To identify sources of tolerance/resistance/immunity among the different types to *Helopeltis* infestation
- b) Practical utility : To mark out otherwise desirable genotypes with tolerance/resistance against the pest. To make available varieties for utilisation in systematic resistance breeding work
- 9 Technical programme : Pest population fluctuations and damage intensity ratings will be monitored on different cultivars and improved types at periodic intervals by observing randomly selected flushes/panicles
- 10 Date of start : 1979
- 11 Likely date of completion : 1980
- 12 Estimated man months :
- 13 Facilities required :
- 14 Financing organisation : KADP Research and Training
- 15 Approximate cost : Rs. 1000/-

(Sd)

PRINCIPAL INVESTIGATOR

PROJECTS ON PEPPER DISEASES

- 1 Institute Code No. : KADP. AG. 5 (a) 19.7 (a)
- 2 ICAR Code No. :
- 3 Name and address of the Institute / Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on pepper
Title of the problem : Slow wilt disease—adoption of suitable cultural practices in addition to plant protection measures to rejuvenate slow wilt affected plants.
- 5 Name and designation of the Principal Investigator : Asst. Professor (Plant Pathology)
- 6 Name(s) and designation of the Associate (s) :
- 7 Location : Cultivators' fields in Kozhikode and Idukki districts.
- 8 a. Objectives : To find out suitable management practices to rejuvenate slow wilt affected pepper plants.
- b. Practical utility : The findings of this experiment can be utilised for adopting proper management practices for rejuvenating slow wilt affected pepper vines.
- 9 Technical programme : A randomized block design should be laid out one each in the slow wilt affected areas of Kozhikode and Idukki districts with the following treatments.
1. Control-local cultivators' practices.
 2. Slow wilt disease control as per the package of practices and the cultural operations as per the cultivators' practices.
 3. Cultural practices and the slow wilt disease control measures as per the package of practices.
 4. As in (3) above + earthing up around the vine (50 cm radius) once in a year., September–October.
 5. As in 4 + mulching,
- 10 Date of start : 1979 June
- 11 Likely date of completion : 1984 June
- 12 Estimated man months : 20
- 13 Facilities required : Staff as per approved project.
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost : Rs. 6000/-

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5 (a) 19.8 (a)
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on pepper
- Title of the problem : Studies on 'Fungal Pollu-etiology (anthracnose disease of pepper) and nature and extent of damage.
- 5 Name and designation of Principal Investigator : Dr. Abi Cheeran, Associate Professor (Plant Pathology)
- 6 Name(s) and designation of Associate(s) : Asst. Professor (Plant Pathology)
- 7 Location : KAU Main Campus Vellanikkara
- 8 a. Objectives : To find out mode of infection and, nature and extent of damage by the fungus *Glomerella cingulata* on different parts of the pepper vines.
- b. Practical utility : The findings of the experiment can be utilized for suggesting effective control measures against anthracnose disease of pepper.
- 9 Technical programme : 1. The mode of infection on different parts of the pepper vine viz. leaf, spike, pedicel and berries will be studied in laboratory and field conditions.
2. Histopathological studies on artificial and naturally inoculated plant parts will be carried out to study the nature of damage.
3. Fifty standards at random should be marked for assessing the crop loss due to the natural infection and the crop loss assessment may be determined by following methods.
- (a) Spike shedding - the number of spikes shed due to the attack of *Glomerella cingulata* has to be separated from the spike shedding due to other factors.
- (b) The number of mature and immature berries attacked by the pathogen has to be counted and the loss in weight of the affected berries determined. The sum total of the above damages is taken as criteria for the assessment of total loss.
- 10 Date of start : June 1979
- 11 Likely date of completion : March 1983
- 12 Estimated man months : 20
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost : Rs. 5000/=

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 5 (a) 19. 8. (b)
2. ICAR Code No. :
3. Name and address of the Res. Institute/Centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on pepper
 Title of the problem : Studies on the ecology of 'Fungal Pollu'. (Anthracnose disease of pepper)
- 5 Name and designation of the Principal Investigator : Dr. Abi Cheeran, Associate Professor (Plant Pathology)
- 6 Name(s) and designation of the Associate (s) : Asst. Professor (Plant Pathology)
7. Location : KAU Main Campus, Vellanikkara,
8. a) Objectives : To find out the critical time of infection for adopting effective control measures in proper time.
 b) Practical utility : The study will help in finding out the correct time to adopt plant protection measures for controlling the anthracnose disease.
9. Technical programme : 1, From the time of flowering onwards the spikes will be collected at weekly intervals and the isolation of the fungus will be done to ascertain the time of infection on spike. The result of the studies will be correlated with atmospheric temperature, relative humidity and rainfall. From this the factors influencing the infection and spread of the disease can be determined.
 2. A fungicidal treatment with four different fungicides viz. Bordeaux Mixture, Anthracnol, Thiride and Difolatan, to control the disease, will be laid out on the basis of the result obtained from the above data, i.e., the time of maximum infection and spread of the disease will be chosen for the application of fungicides.
- 10 Date of start : June 1978
- 11 Likely date of completion : June 1983
- 12 Estimated man months : 24
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost : Rs. 10,000/-

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP. AG. 5 (a) 19.8.(c)
2. ICAR Code No. :
3. Name and address of the Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on pepper
Title of the problem : The effect of prophylactic control measures of 'Quick Wilt' (Stem Rot) disease on control of Fungal Pollu (Anthracnose) of pepper.
- 5 Name and designation of the Principal Investigator : Dr. Abi Cheeran
Associate Professor (Plant Pathology)
- 6 Name (s) and designation of the Associate (s) :
Asst. Professor (Plant Pathology)
- 7 Location : KAU Main Campus, Vellanikkara
- 8 a) Objectives : To determine whether the prophylactic control measures now practiced against the "quick wilt" disease of pepper is sufficient to control the "fungal pollu" or whether separate control measures for the disease is necessary.
- b.) Practical utility : The results of the experiment can best be utilized for minimising the use of fungicides for controlling diseases of pepper, thereby achieving more economy and minimum toxic hazards.
- 9 Technical programme : A field experiment (RBD) will be laid out with 3 year old pepper vines and the following treatments will be given.
- 1 Quick wilt control measures as per the package of practices.
 - 2 Fungal pollu control measures as per the package of practices.
 - 3 Quick wilt and fungal pollu control measures as per the package of practices.
 - 4 Control—No treatment.
This experiment will be continued atleast for three years to get a confirmed result.
- 10 Date of start : June 1979
- 11 Likely date of completion : June 1982
- 12 Estimated man months : 24
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost : Rs. 10,000/-

(Sd)
PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5 (a) 19.9. (a)
- 2 ICAR Code No. :
- 3 Name and address of Research Institute/Centre : College of Horticulture. Vellanikkara.
- 4 Title of the project : Research on pepper
Title of the problem : Quick wilt disease of pepper-ecological studies.
- 5 Name and designation of the Principal Investigator : Dr. Abi Cheeran
Associate Professor (Plant Pathology)
- 6 Name (s) and designation of Associate (s) :
- 7 Location : KAU Main Campus, Vellanikkara.
- 8 a. Objectives : To study the correlation between macro and micro climatic factors and the incidence of the disease to determine the agro climatic factors which are congenial for the out break of the disease in an epiphytotic form.
- b. Practical utility : The correct knowledge of the agro climatic factors which favour the out break of the disease will enable to predict the incidence of the disease in advance and adopt suitable prophylactic control measures in time by disease forecasting system.
- 9 Technical programme : An isolated plot in the pepper garden of KADP at KAU main campus, where the disease has been appearing continuously for the last few years, will be selected for the experiment. The agro climatic factors such as soil temperature, soil moisture, atmospheric temperature, relative humidity, light intensity, total rainfall and its distribution in this area and the spore load of the pathogen in atmosphere will be recorded continuously for four years. The incidence and spread of the disease in field during this period will be closely watched and recorded. From this the correlation between the above factors and the incidence of the disease can be worked out.
- 10 Date of start : May 1980
- 11 Likely date of completion : June 1984
- 12 Estimated man months : 48
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost (Per year) : Rs 50,000/

(Sd)
PRINCIPAL INVESTIGATOR

- 1 Institute Code No. : KADP. AG. 5(a). 19. 9 (b)
- 2 ICAR Code No. :
- 3 Name and address of the Institute/Centre : College of Horticulture, Vellanikkara.
- 4 Title of the project : Research on pepper
- Title of the problem : Quick wilt disease of pepper—survey of the collateral host of *Phytophthora palmivora* (Butler) Butler., especially the weeds and other economical plants usually seen in pepper gardens of Kerala.
- 5 Name and designation of the Principal Investigator : Dr. Abi Cheeran, Associate Professor (Plant Pathology)
- 6 Name (s) and designation of the Associate (s) :
- 7 Location : KAU, Main Campus, Vellanikkara.
- 8 a. Objectives : To find out the host range of the pathogen especially the weeds and other economical plants usually seen in pepper gardens of Kerala.
- b. Practical utility : The unwanted collateral hosts can be eradicated from the pepper gardens for reducing the inoculum potential for checking the disease incidence and spread.
- 9 Technical programme : At random two pepper gardens from each district of Kerala will be selected for the screening work. The survey will be done at monthly intervals and the occurrence of the *Phytophthora palmivora* will be recorded on all the vascular plants in the pepper garden at least for a period of 3 years. At the end of the work a host index catalogue of the *Phytophthora palmivora* in the pepper gardens of Kerala will be prepared.
- 10 Date of start : April 1980
- 11 Likely date of completion : April 1983
- 12 Estimated man months : 24
- 13 Facilities required : Staff as per approved project
- 14 Financing organisation : KADP Research & Training
- 15 Approximate cost : Rs. 15,000/-

(Sd)

PRINCIPAL INVESTIGATOR

1. Institute Code No. : KADP AG. 5 (a) 19. 9 (c)
2. ICAR Code No. :
3. Name and address of the Res. Institute/Centre : College of Horticulture, Vellanikkara.
4. Title of the project : Research on pepper
Title of the problem : Quick wilt disease of pepper—Symptomatological studies
5. Name and designation of Principal Investigator : Dr. Abi Cheeran, Associate Professor (Plant Pathology)
6. Name (s) and designation of Associate(s) : K. P. Mammooty, P. G. Student.
7. Location : KAU Main Campus, Vellanikkara.
8. a) Objectives : To study the symptoms expressed by the pepper vines during the pathogenesis starting from the early stages of infection on different parts of the plants viz. root, stem, branches and leaves and to find out the proper time of fungicide application.
- b) Practical utility : The study will help in detecting and diagnosing the disease in the field at any stage of infection. This information can be utilised to find out the stages of the disease at which it can be controlled effectively by application of fungicides under semifield conditions.
9. Technical programme : One year old rooted cuttings of pepper vine will be inoculated with standardized pure culture of *Phytophthora palmivora* isolated from the diseased pepper plants.
The inoculation will be made on different parts of the plant viz. roots, stem, branches and leaves. The symptom development on different plant parts will be closely observed and recorded at 48 hrs. intervals, so as to get detailed and exhaustive information on the symptom expression of the disease at every stage of disease development.
Along with this, fungicides (Bordeaux Mixture 1%, Thiram, Zineb, Maneb and Bayer 5072) will be applied on the affected plants at different stages of the advancement of disease and observation will be taken to find out the stage at which the disease can be controlled.
10. Date of start : April 1977
11. Likely date of completion : December 1978
12. Estimated man months : 20
13. Facilities required : Staff as per approved project
14. Financing organisation : KADP Research & Training
15. Approximate cost : Rs. 10,000/-

(Sd)

PRINCIPAL INVESTIGATOR

**SANCTIONED STAFF OF THE KADP RESEARCH
AND TRAINING BY KAU**

Agricultural University of Kerala	Scale of pay	No.
Professors of Horticulture (one for each crop in coconut, cocoa, cashew and pepper)	Rs. 1200-1750	4
Associate Professors (one each for Instrumentation Radiology (Safety Officer) Chemistry (Radio tracer)	Rs. 850-1450	3
Assistant Professors (one each for Horticulture Plant Pathology Nematology Virology Biochemistry Soil science)	Rs. 600-1250	6
Supporting staff:		
1 Stenographer Grade I	Rs. 325-660	1
2 Asst. Grade II	Rs. 240-445	1
3 Agri. Demonstrators Grade II	Rs. 240-445	2
4 Lab Attenders	Rs. 230-385	2

LIST OF MAJOR EQUIPMENTS

- 1 Atomic absorption photometer
- 2 Amino acid analyser
- 3 Auto analyser
- 4 Computing system
- 5 Electrophoresis apparatus
- 6 Flame photometer
- 7 Gas chromatograph
- 8 Photographic unit
- 9 Refrigerated centrifuge
- 10 Research microscopes
- 11 Ultra centrifuge
- 12 UV/Vis. Spectrophotometer
- 13 Xerox machine
- 14 Liquid scintillation system
- 15 Thin layer chromatography

- 1 Institute Code No. :
 2 ICAR Code No. : 813
 3 Name & address of the Research Institute/Centre : CPCRI Regional Station, Calicut
 4 Title of the projet : Research on pepper
 Title of the problem : Role of nematodes in the incidence of slow wilt disease of pepper and screening the germplasm against nematodes.
 5 Name and designation of Principal Investigator : Scientist S2
 6 Name(s) and designation of Associate(s) : Scientist S1
 7 Location : CPCRI Regional Station, Calicut
 8 a. Objective : To understand the exact role of plant parasitic nematodes *Meloidogyne incognita* and *Radopholus similis* in slow wilt complex of pepper and to screen all cultivars and wild types against *M. incognita* and *R. similis*.
 b. Practical utility : The information helps in standardising the control measures of the disease and to identify the resistant/tolerant types to plant parasitic nematodes. The resistant types can be utilised in breeding programmes to evolve nematodal resistant and productive varieties.
 9 Technical programme : a. Survey of slow wilt affected pepper gardens for plant parasitic nematodes in general and root knot and burrowing nematodes in particular in roots of pepper and in soils.
 b. Establishing the pathogenicity of nematodes on pepper and their effects on the health of pepper in pot culture experiments
 c. Standardisation of screening techniques.
 d. Control measures.
 10 Date of start : April, 1978 (subjected to the posting of Scientists)
 11 Likely date of completion : 1983
 12 Estimated man months : 120
 13 Facilities required
 Equipments : Stereo microscope - 2 Nos. Rs 20,000/-
 14 Financing organisation : ICAR
 15 Approximate cost
 a. Pay of staff
 Scientist S2 (Nematology) }
 Scientist S1 (Nematology) } Rs. 1,88,814/-
 Jr. Tech. Asst. T1 }
 b. Equipments 20,000/-
 c. Contingencies 20,000/-
 Total Rs. 2,28,814/-

(Sd)
 PRINCIPAL INVESTIGATOR

- 1 Institute CodeNo. :
- 2 ICAR Code No. : 813
- 3 Name and address of the Research Institute/Centre : CPCRI Regional Station, Calicut
- 4 Title of the project : Research on pepper
- Title of the problem : Epidemiology studies on quick wilt and slow wilt diseases of pepper.
- 5 Name and designation of Principal Investigator : Scientist S2 (60%)
- 6 Name (s) and designation of Associate (s) : Scientist S1 (40%)
- 7 Location : CPCRI Regional Station, Calicut.
- 8 a. Objectives : To identify the primary source of inoculum, pre-disposing factors of the quick wilt disease development, biology and nature of survival of *Phytophthora palmivora*.
- b. Practical utility : The information helps to forecast the disease outbreaks and to standardise control measures.
- 9 Technical programme : i Identifying the primary source of inoculum
ii Predisposing factors of the disease viz. soil moisture, temperature, nycto-temperature, humidity etc.
iii Collection of meteorological data in relation to the disease incidence for the forecasting measures.
iv Studying the effect of soil moisture and temperature under controlled conditions.
v Nature of survival of *Phytophthora palmivora*.
vi Biology of *P. palmivora*.
- 10 Date of start : April, 1978 (subjected to the posting of Scientists)
- 11 Likely date of completion : 1983
- 12 Estimated man months : 60
- 13 Facilities required : Equipments:
- | | | |
|------------------------------------|-----|--------------|
| Soil temperature tanks – 3 Nos. | Rs. | 60,000 |
| Thermo-hygrographs – 4 Nos. | Rs. | 20,000 |
| Trinocular res. microscope - 1 No. | Rs. | 75,000 |
| BOD Incubator | Rs. | 25,000 |
| | | Rs. 1,80,000 |
- 14 Financing organisation : ICAR

15 Approximate cost

: a) Pay of staff	
Scientist S2 (60%)	Rs. 57,348
Scientist S1 (40%)	Rs. 40,518
Jr. Tech. Assistant T1,;	Rs. 39,450
b) Equipments	Rs. 1,80,000
c) Contingencies	Rs. 50,000
	<hr/>
Total	Rs. 3,67,316
	<hr/>

(Sd)

PRINCIPAL INVESTIGATOR

1 Institute Code No. :
2 ICAR Code No. : 813
3 Name and address of the Research Institute / Centre : CPCRI Regional Station, Calicut
4 Title of the project : Research on pepper
Title of the problem : Screening of germplasm materials for resistance/tolerance to quick wilt and slow wilt and evolving effective control measures.
5 Name and designation of Principal Investigator : Scientist S1 (60%)
6 Name(s) and designation of Associate(s) : Scientist S2 (40%)
7 Location : CPCRI Regional Station, Calicut.
8 a) Objectives : Screening of all the available cultivars in Kerala and wild types of pepper from Western Ghats, Eastern Ghats and Assam, against *Phytophthora palmivora* and causal agent of slow wilt.
b) Practical utility : Identification of resistant/tolerant types and utilising them in the breeding programmes of pepper to evolve wilt resistant and productive varieties.
9 Technical programme : a) Screening of all available cultivars for wilt resistance.
b) Screening of wild types for wilt resistance.
c) Identifying physiological races of *Phytophthora palmivora*, if any
10 Date of start : April 1978 (subjected to the posting of Scientists)
11 Likely date of completion : 1983
12 Estimated man months : 60
13 Facilities required : Equipments :
Growth Chambers Rs. 2,00,000
14 Financing organisation : ICAR
15 Approximate cost : a) Pay of staff
Scientist S1 (60%) Rs. 40,518
Scientist S2 (40%) Rs. 38,232
Driver Rs. 25,704
b) Equipments Rs. 2,00,000
c) Contingencies Rs. 50,000
d) Vehicle (Mini Bus) Rs. 75,000
Total Rs. 4,29,454

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. : 813
- 3 Name & address of Research Institute /Centre : CPCRI, Regional Station, Calicut.
- 4 Title of the project : Research on pepper
- Title of the problem : Studies on the impact of input technology on the yield performance and quality attributes of pepper.
- 5 Name & designation of Principal Investigator : Scientist S2 (Agronomy)
- 6 Name(s) & designation of Associate(s) :
- 7 Location : CPCRI, Regional Station, Calicut
- 8 a) Objectives : Very little work is reported on the input requirements of pepper under the soil and climatic conditions of Kerala. Though some manurial experiments were initiated as early as in 1818 at Taliparamba and response to fertilisers (N, P and K) and organic manures established (Menon, K. K. 1949, Indian J. Agric. Sci., 19: 89 - 136), present fertiliser recommendations are totally arbitrary. Nutritional deficiency symptoms and critical levels of nutrient concentrations have been reported from other countries like Malaysia but we have no research data on these aspects or nutrient removal by the crop. The best method and time of application of fertilisers are not established. An economic evaluation of fertiliser response is lacking. Agronomic practices (eg. spacing and choice of standards) adopted by farmers on virgin lands are still being recommended for a wide variety of conditions including multiple cropping systems in coconut and arecanut gardens.
- b) Practical utility : The results from the envisaged studies will form the base for recommending fertilisers and agronomic practices to the farmers.
- 9 Technical Programme : i) Field experiments to evaluate the response of pepper to different levels of N, P and K fertiliser and organic matter, with respect to yield, stage of maturity and quality.
- ii) A field experiment to determine the optimum spacing for the important commercial varieties under cultivation, i.e. Panniyur-1, Karimunda, Kalluvally and Kottanadan.
- iii) Soil testing and tissue analysis to assess the nutrient requirement of the crop and to establish critical nutrient concentrations in plant tissues and soils.
- iv) To determine the effect of different cultural practices on the incidence of slow wilt disease.
- 10 Date of start : May, 1978 (only fertiliser trial will be taken up during 1978' subjected to the posting of the Scientist S2 (Agronomy).

11	Likely date of completion	:	1985		
12	Estimated man months	:	84		
13	Facilities required	:	Facilities available at the Regional Station, Calicut will be utilised and some of the miscellaneous equipments required for basic agronomical studies will be purchased.		
14	Financing organisation	:	ICAR		
15	Approximate cost (till the end of 5th year)	:	a) Pay of staff	:	Rs. 95,5800
			b) Contingencies and other miscellaneous equipments	:	Rs. <u>75,00</u>
			Total	:	Rs. <u><u>1 70 580</u></u>

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. : 813
- 3 Name and address of the Research Institute/Centre : CPCRI Regional, Station, Calicut.
- 4 Title of the project : Research on pepper
Title of the problem : Bionomics of major pests of pepper and evolving integrated control measures against them.
- 5 Name & designation of Principal Investigator : Scientist S3 (Entomology)
- 6 Name (s) & designation of Associate (s) : Nil
- 7 Location : CPCRI, Regional Station, Calicut.
- 8 a) Objectives : To study the biology, bionomics and mode of survival of the pests during the off season and to evolve a suitable integrated control schedule.
b) Practical utility : By evolving a suitable pest management schedule, production can be increased to a great extent.
- 9 Technical programme : The major work will be taken up on the following pests:
i) Pollu beetle (*Longitarsus nigripennis*)
ii) Top shoot borer (*Laspeyresia hemidoxa* Meyr.)
iii) Stem borer (*Dihoma procera* Pase, *Pterlophia annulata* chev.)
a) Biology and bionomics b) Seasonal abundance c) Screening pepper cultivars to locate resistance/tolerance d) Insecticidal trial
e) Suitable timing for plant protection operation f) Natural enemies
g) Biological control.
- 10 Date of start : April 1978 (subjected to the posting of Scientist S3)
- 11 Likely date of completion : 1983
- 12 Estimated man months : 60
- 13 Facilities required :
Equipments : Stereomicroscope-1 Rs. 10,000/-
- 14 Financing organisation : ICAR
- 15 Approximate cost :
a) Pay of staff
Scientist S3 : Rs. 1,22,670
Tech. Asst. T2 : Rs. 31,455
b) Equipments : Rs. 10,000
c) Contingencies : Rs. 20,000
Total : Rs. 3,45,250

(Sd)
PRINCIPAL INVESTIGATOR

1	Institute Code No.	:	
2	ICAR Code No.	:	813
3	Name and address of the Research Institute/Centre	:	CPCRI, Regional Station, Calicut
4	Title of the project	:	Research on pepper
	Title of the problem	:	Studies on biochemical aspects of pepper.
5	Name and designation of the Principal Investigator	:	Scientist S2 (Biochemistry)
6	Name(s) and designation of Associate (s)	:	Scientist S2 (Biochemistry)
7	Location	:	CPCRI Regional Station, Calicut.
8	a) Objectives	:	a) To study the bio-synthetic pathways of the active principles in pepper. b) To characterise the quality standards for pepper. c) To study the effect of maturity, plant protection chemicals and improved agro-techniques on quality.
	b) Practical utility	:	Identification of the stage of maturity at which the oleoresin content will be the maximum, as well as varieties with high oleoresin content, is essential in view of anticipated shift in export from black pepper to oleoresin, in the near future. Export of oleoresin is expected to save considerable amount in freightage also. The residual analysis with respect to plant protection chemicals is essential in view of the strict quality standards prescribed by the consuming countries.
9	Technical programme	:	a) To work out the bio-synthetic pathways of active principles like piperin. b) To screen the cultivars with respect to quality and to identify the cultivars/species with high percentage of oleoresin, piperin, N. V. Ether extract etc. c) To determine the stage of maturity with respect to quality characteristics of pepper. d) To prescribe quality standards of pepper for market acceptance. e) To study the effect of plant protection chemicals and improved agro-techniques on quality and residual analysis of plant protection chemicals in the finished product.
10	Date of start	:	May, 1978
11	Likely date of completion	:	1983
12	Estimated man months	:	120
13	Facilities required	:	Equipments
			1) Spectro-photometer—1 No. Rs. 1,00,000
			2) Gas chromatographic unit—1 No. Rs. 1,00,000
			3) Wiley Mills—2Nos. Rs. 10,000
			4) Mettler analytical balance Rs. 20,000
			<u>Rs. 2,30,000</u>
14	Financing organisation	:	ICAR
15	Approximate cost	:	
			a) Pay of staff
			(Scientists S ₂ (Biochemistry)—2) Rs. 1,91,160
			b) Equipments Rs. 2,30,000
			c) Contingencies & other miscellaneous equipments Rs. 20,000
			<u>Rs. 4,41,160</u>
			Total

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. :
- 3 Name and address of Research Institute/Centre : CPCRI, Regional Station, Kayamkulam.
- 4 Title of the project : Research on coconut
Title of the problem : Studies on certain phenols, glycosides, growth hormones and water stresses in coconut in relation to root (wilt) disease.
- 5 Name and designation of Principal Investigator : Plant Physiologist, Scientist S-3.
- 6 Name (s) and designation of Associate (s) : Plant Physiologist, Scientist S-1.
- 7 Location : CPCRI, Kayamkulam.
- 8 a. Objectives : To investigate whether imbalance in phenols, glycosides, growth hormones and soil water are involved in causing root (wilt) disease and whether their balanced application can cure the disease.
- b. Practical utility : Phenols, tannins and glycosides have been reported to induce resistance/tolerance in plants against pathogens. In many diseased and water stressed plants the imbalance in the synthesis of aforesaid chemicals besides growth hormones is observed as a result of which drastic drop in their vegetative and reproductive growth is caused. Application of depleted substances to such plants has been reported to restore their normal growth.
- Some preliminary studies conducted at CPCRI, Regional Station, Kayamkulam have indicated that the application of caffeic acid, coumarin and gallic acid in combination and ascorbic acid alone can improve the nut yield and vegetative growth of root (wilt) affected coconut palms significantly. On the other hand, the water stresses have been found to aggravate the disease but the balanced water supply has improved the yield of diseased palms. The reduction in total phenol and depletion in ethanol extractable phenolic compounds have been recorded in diseased palms under an introductory experiment. However, no systematic experiment has been conducted so far to study the changes in phenolic compounds, glycosides and growth hormones and the effect of their application on the growth and yield of root (wilt) diseased coconut palms. The study is therefore envisaged.
- Balanced use of desired phenols, glycosides, growth hormones and water level will be definitely helpful in improving the growth and yield of diseased palms and their regular application for few years will cure the palms.
- 9 Technical programme : **A. Field experiments**
i) Experiments will be conducted on diseased palms at border areas and at / near CPCRI, Kayamkulam, in farmers' gardens using indole butyric acid, naphthalene acetic acid, gibberellic acid, cytokinins, abscisic acid, coumarin, gallic acid,

chlorogenic acid, caffeic acid, diacetoxys cirpenol and phosphoglycosides alone and in certain combinations. ii) Low concentration of these substances will be applied once in two months by foliar spray or through root/stem/leaf axil depending upon vigour of plant and season. iii) Effect of these treatments on nut yield, condition of spindle, root growth (especially the per cent reduction in root decay), number of flaccid and senescent leaves and rate of leaf production will be recorded. iv) All the palms will receive balanced inorganic nutrients and known plant protection measures.

B. Tank culture experiment

i) One year old healthy seedlings will be grown in cement tanks at three levels of water stress with and without the combination of few phenolic glycoside and growth hormone compounds. ii) Determination of cytokinin/abscisic acid ratio, total and different fractions of phenols and glycosides, relative water deficit, water and osmotic potential of leaves, stomatal index and K-content in guard cells. iii) Effect of water stress alone and in combination with chemicals on the onset of disease, induction of flowering, nut yield and other characters as mentioned in field experiment will be recorded.

Exploratory analysis for total and the different fractions of phenols and glycosides and the bioassay of auxin, gibberellin, cytokinin and abscisic acid in the different parts of early, middle and advanced diseased, apparently healthy and healthy palms growing in laterite, sandy loam and water saturated soils will be done so as to find out whether some more specific or excluded chemicals other than those mentioned above could be included in the lay out of field and tank culture experiments.

Trials will be made using some of the tagged substances (to be used in field and tank culture experiments) on diseased palms in radio isotope garden at Kayamkulam to know the nature of their movement and efficiency of absorption by different organs so as to find out the ways for better recovery and quick response of chemical under field and tank culture experiments.

10	Date of start	:	
11	Likely date of completion	:	After 5 years of date of start
12	Estimated man months	:	120
13	Facilities required	:	Cement tanks Rs. 50,000 Thermocoupled psychrometer Rs. 10,000 Chemical & other contingencies Rs. 10,000
14	Financing organisation	:	ICAR
15	Approximate cost	:	Rs. 2,60,250/-

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute : CPCRI, Regional Station, Kayamkulam
- 4 Title of the project : Research on coconut
Title of the problem : Role of *Radopholus similis* in the coconut root (wilt) complex.
- 5 Name and designation of Principal Investigator : Scientist S3-Nematology.
- 6 Name (s) and designation of Associate (s) : Scientist S1-Nematology.
- 7 Location : CPCRI, Regional Station, Kayamkulam.
- 8 a) Objectives : To find out (i) the role of *R. similis* singly and in combination with *Cylindrocarpon* sp. in the incidence of root (wilt) disease of coconut. (ii) the effect of nematicides in the control of *R. similis* and root (wilt) disease, if any.
- b) Practical utility : Among the 23 plant parasitic genera of nematodes recorded in the root zone of root (wilt) affected coconut palms, the burrowing nematode, *Radopholus similis*, is the most important. The burrowing nematode population at Kayamkulam identified as the "banana race" is known to parasitise 39 species of plants including many weeds, fodder and food crops. Burrowing nematode population as high as 3941 has been recorded from one gram of root. Healthy seedlings in pot culture on inoculation with *R. similis* produced characteristic reddish brown cortical lesions. These lesions coalesced and enlarged to cause severe root rot and reduction in lateral root production. The inoculated seedlings exhibited stunting and retardation of growth. A new species of the fungus *Cylindrocarpon* has been isolated from the lesions caused by nematodes which is found to accelerate rotting. Since root rotting is a primary and major symptom in the root (wilt) syndrome critical and definitive studies on the role of the nematode, *R. similis* alone and in combination with *Cylindrocarpon* in the causation of root rotting and root (wilt) disease becomes very important. Studies on control of *R. similis* through various methods would be very much necessary if *R. similis* has any role in the incidence of root (wilt) disease.
- 9 Technical programme : 1. The distribution and intensity of *R. similis* and other nematode populations in relation to the disease.
2. Pathogenicity of *R. similis* and *Cylindrocarpon* sp. singly and in combination using various levels of inoculum.
3. Effect of nematicide on *R. similis* population and in the integrated control of root (wilt) disease.
4. Screening of coconut germplasm against *R. similis*.
5. Developing suitable crop combination for root (wilt) affected gardens to suppress the *R. similis* population in view of the

susceptibility of large number of usual intercrops like banana, ginger, hybrid napier, nutmeg etc to *R. similis*.

- 10 Date of start : As and when the principal investigator joins
- 11 Likely date of completion : 5 years after beginning.
- 12 Estimated man months : 120
- 13 Facilities required : Minor equipment Rs. 10, 000
Contingencies Rs. 20, 000
T. A. Rs. 10, 000
- 14 Financing organisation : ICAR
- 15 Approximate cost : Rs. 2, 30, 250

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. :
- 3 Name and address of Research Institute / Centre : CPCRI, Regional Station, Kayamkulam,
- 4 Title of the project : Research on coconut
 Title of the problem : Microbiological studies on coconut root (wilt) disease.
 1) Role of bacteria.
 2) Bactericidal trials.
 3) Inter and mixed cropping trials.
 4) Integrated control trials.
 5) Microbial antagonists.
- 5 Name and designation of Principal Investigator : Microbiologist S (3)—one.
- 6 Name (s) and designation of associates (s) : Microbiologist S (1)—two.
- 7 Location : CPCRI Regional Station, Kayamkulam.
- 8 a. Objectives : 1) Elucidation of the role of bacteria in root (wilt) disease.
 2) Chemical control of root (wilt) disease with antibiotics.
 3) Inter and mixed cropping as a management practice in coconut root (wilt) affected tracts.
 4) To follow the influence of different chemicals on the microbial equilibrium of coconut soils.
 5) Control of coconut root (wilt).
- b. Practical utility : 1) Studying the association of *Enterobacter* possessing wilt inducing toxic principles in coconut root (wilt).
 2) The coconut *Enterobacter* isolates are sensitive to streptomycin and broad spectrum antibiotics like tetracycline and oxytetracycline. Trials are underway to assess the effect of these antibiotics on the remission of root (wilt) symptoms. More elaborate investigations are required to assess the uptake, translocation and persistence of antibiotics in coconut root (wilt) affected palms.
 3) Coconut under inter cropping with fodder crops in the root (wilt) affected region recorded an increased yield and favourable colonization of beneficial microflora. The possibility of altering physiologically distinct microflora in the root region of palms as a result of intercropping different crops are frequently used methods of biological control. Investigations contemplated will yield information useful for transfer to the cultivators.
 4) Control of plant diseases with chemicals, individually or in combination, with or without organic amendments, has been successfully attempted. The use of chemicals particularly in combinations can have a direct or indirect effect on the soil microbial equilibrium. Investigations on soil microflora and their activity in areas having integrated management practices will be rewarding.
 5) The presence of microbial antagonists in soil can exert a check on certain kinds of pathogenic diseases. The lack of understanding of the exact nature of the pathogen is a limiting factor in the context. Nevertheless, it may be worthwhile to screen the root (wilt) free regions for the presence of microorganisms antagonistic to the microflora found constantly associated with root (wilt) disease.

- 9 Technical programme
- 1) i. Large scale fractionation and characterization of the toxin. Development of a suitable technology for the *in vitro* screening of the bacteria and their toxic fractions with a view to understanding their role in pathogenicity.
 - 2) i. Standardisation of the mode of application of antibiotics and periodicity. ii. Studies on the translocation and persistence in coconut palms and its effect on the remission of symptoms.
 - 3) i. Studies on nitrogen fixing organisms and nitrogenase activity in soil and plant core of palms under inter and mixed cropping. ii. Soil microbial activities including phosphate solubilization, cellulolysis, denitrification and nitrification. iii. Impact of crop mixing and intercropping on yield and symptoms of root (wilt) affected palms.
 - 4) i. Population dynamics (soil microbial) in relation to pesticide application. ii. Microbial interactions.
 - 5) i. Screening of coconut soils and rhizosphere in the root (wilt) free region for microbial antagonists. ii. Standardisation and application of bulk culture in root (wilt) affected areas and assessment of their favourable influence.
- 10 Date of start : :
- 11 Likely date of completion : Five years from the date of start.
- 12 Estimated man months. : 180.
- 13 Facilities required :
- | | | | |
|---|---------------------|---|------------------|
| I Equipments | a) Microscopes | 2 | Rs. 30,000/- |
| | b) Laminar Flow | 1 | Rs. 20,000/- |
| | c) Deep freezer | 1 | Rs. 7,000/- |
| | d) B.O.D. incubator | 1 | Rs. 10,000/- |
| II Contingencies | | | Rs. 60,000/- |
| III Major equipment (for whole station recording spectrophotometer) | | | 1 Rs. 1,24,000/- |
- 14 Financing organisation : ICAR
- 15 Approximate cost : (Excluding staff) Rs. 2,52,000/-

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : CPCRI., Regional Station, Kayamkulam.
- 4 Title of the project : Research on coconut.
Title of the problem : Rejuvenation of coconut root (wilt) diseased gardens in heavily infected areas and prevention of its spread to unaffected areas.
- 5 Name and designation of Principal Investigator : New appointment
- 6 Name (s) and designation of Associate (s) :
- 7 Location : Diseased tract – CPCRI., Regional Station, Kayamkulam Border - Keezhpallikara.
- 8 a. Objectives : Control of the disease through better management.
b. Practical utility : Management of diseased gardens – prevention of spread of disease to new areas.
- 9 Technical programme : **Experiment I** Rejuvenation of coconut root (wilt) diseased gardens through integrated methods of control and the adoption of suitable agro techniques.
Area of operation – 3 ha. plot – 50 palms/treatment.

Plan of work

Adoption of following treatments (NPK, Ca, Mg and trace elements application and plant protection measures applicable to all treatments)

- 1 Intercropping — preferably legumes.
- 2 Irrigation.
- 3 Dasanit — 5 gm in 2 split doses.
- 4 Benlate/Bavistin — 7 gm/tree/year, 2 split doses.
- 5 Bactericide — 3 gm/tree/year — 3 split doses.
- 6 Dasanit + Bavistin + Bactericide.
- 7 Dasnit + Bavistin.
- 8 Bavistin + Bactericide.
- 9 Bactericide + Dasanit
- 10 Record the effect of treatments and economic evaluation of the practices.

Experiment II Prevention of root (wilt) disease spread in a mildly infected area through the adoption of eradication of uneconomic palms and package of practices.

Plan of work

- 1 Eradication of uneconomic diseased trees/seedlings including boles after spraying with 0.05% carbaryl or dichlorvos.
- 2 Burning the pits after removal of roots.

- 3 Replanting with quality seedlings.
- 4 Adoption of package of practices on existing adult palms (10 palms around the diseased area) — 15 M²
- 5 Record observations on the condition of the plots at half yearly intervals.
- 6 Testing of apparently healthy palms around the diseased biochemically and serologically.

Experiment III — do — without eradication of diseased palms and adoption of package of practices.

Plan of work

- 1 Adoption of package of practices on existing adult palms including the diseased areas (10 palms around the diseased area) — 15 M²
- 2 Second observation on the condition of the plots at half yearly intervals

- | | | | |
|----|--|---|------------------------------------|
| 10 | Date of start | : | |
| 11 | Likely date of completion | : | Five years from the date of start. |
| 12 | Estimated man months | : | 300 |
| 13 | Facilities required | : | Staff as per approved project |
| 14 | Financing organisation | : | World Bank/ICAR |
| 15 | Approximate cost
(excluding pay of staff) | : | 7,50,000/- |

(Sd)

PRINCIPAL INVESTIGATOR

- 1 Institute Code No. :
- 2 ICAR Code No. :
- 3 Name and address of the Research Institute/Centre : CPCRI., Regional Station, Kayamkulam,
- 4 Title of the project : Research on coconut
 Title of the problem : Screening of coconut germplasm, varieties, cultivars, hybrids and escapes for resistance/tolerance to coconut root (wilt) disease.
- 5 Name and designation of Principal Investigator : Vacant
- 6 Name (s) and designation of Associate(s) : Vacant
- 7 Location : CPCRI., Regional Station., Kayamkulam and growers' field in diseased areas.
- 8 a. Objectives : To locate disease resistance.
 b. Practical utility : Identification of planting material suitable for disease affected gardens.
- 9 Technical programme : 1 World collection of germplasm.
 2 Screening varieties/hybrids/cultivars for resistance to the disease under different agro-climatic and soil conditions.
 3 Adoption of package of practices.
 4 Record of observations at half yearly intervals,
- 10 Date of start : As and when scientists are appointed.
- 11 Likely date of completion : Five years from the date of start.
- 12 Estimated man months : 240
- 13 Facilities required :
- 14 Financing organisation : World Bank/ICAR.
- 15 Approximate cost (excluding pay of staff) : Rs. 2,90,000/-

(Sd)

PRINCIPAL INVESTIGATOR

800895



1. Institute Code No. :
2. ICAR Code No. :
3. Name and address of the Research Institute/Centre : CPCRI., Regional Station, Kayamkulam.
4. Title of the project : Research on coconut.
Title of the problem : Electron microscopic and serological studies for the identification of virus or like agents associated with root (wilt) disease.
5. Name and designation of Principal Investigator : New appointment
6. Name(s) and designation of Associate (s) : New appointment
7. Location : CPCRI., Regional Station, Kayamkulam
8. a.) Objectives : Understanding the etiology of the disease.
b.) Practical utility : To evolve better methods of control.
9. Technical programme : 1. Electron microscopic examination of leaf and root sap, fractionated samples (leaf, root, inflorescence and phloem sap) of healthy and diseased palms and vectors by negative staining and shadow casting technique.
2. Leaf dip serology.
3. Serologically specific electron microscopy of purified fractions, leaf and root sap, phloem sap, plant and vector tissues.
4. Elution and examination of serologically specific precipitating bands.
5. Elution and examination of PAGE fractions.
6. Examination of ultra-thin sections of plant and vector tissues.
7. Location of sites of multiplication, translocation and distribution pattern and other ultrastructural abnormalities in the host and vectors by fluorescence antibody technique.
10. Date of start :
11. Likely date of completion : Five years from the date of start.
12. Estimated man months : 120
13. Facilities required : Equipments:
1. Spares for ultracentrifuge Rs. 40,000 (to be imported.)
2. Fraction Collector Rs. 30,000.
3. Microscope with all accessories for fluorescence phase and dark field microscopy for item 7 Rs. 1,75,000
4. Chemicals Rs. 30,000
(EM facilities available at UAS, Bangalore to be used on a collaborative basis for the time being).
14. Financing organisation : World Bank/ICAR.
15. Approximate cost (excluding pay of staff) : Rs. 2,75,000/-.

(Sd)

PRINCIPAL INVESTIGATOR