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LAB TO LAND MANUAL

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Golden Jubilee Celebrations

1979

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IN KAU/LA 1979

Director: **Dr. V. S. S. POTTI**
Director of Extension Education
Kerala Agricultural University
Vellanikkara

Co ordinator: **A. I. THOMAS**
Associate Professor
National Demonstration Project
Kerala Agricultural University
Vellanikkara

PREFACE

The Indian Council of Agricultural Research has completed 50 years of its fruitful service to the Nation. As part of the Golden Jubilee Celebrations, ICAR has drawn up an ambitious programme, co-ordinating Agricultural Universities, State Research Stations and selected Voluntary Organisations in the country. The programme involves the transfer of technology for the improvement of the economic well-being of 50,000 farming families based on improvement in their entire farming systems.

The Kerala Agricultural University has selected 500 small, marginal farmers, landless labourers and tribal farmers for the implementation of the National Programme through increased productivity in these farmsteads and providing the farmers with full employment during the year leading to better standard of living. University has also drawn up a comprehensive programme for the development of these homesteads through the Research Stations and Institutions of the University spread all over the State. The interdisciplinary group organised for drawing up the programme for implementation has prepared a LAB TO LAND MANUAL. I am sure the valuable information documented in this publication will be highly useful to the extension workers in the fields of Agriculture and Animal Husbandry.

Vellanikkara,
30..5..1979

(Dr.V.S.S.POTTI)
Director of Extension Education
Kerala Agricultural University.

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Participation in

I.C.A.R. GOLDEN JUBILEE CELEBRATIONS, COORDINATION COMMITTEE

MEMBERS

***

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3.	Dr.U.P.Bhaskaran, Director of Research, Kerala Agricultural University, Vellanikkara. ..	Member
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8.	Shri.P.N.Pisharody, Special Officer, Institute of Agricultural Technology, Tavanur. ..	"
9.	Shri.K.I.James, Associate Professor, Rice Research Station, Pattambi. ..	"
10.	Sri.P.G.Veeraraghavan, Associate Professor, Directorate of Research, Kerala Agricultural University, Vellanikkara. ..	"
11.	Sri.K.Mammen, Assistant Professor, Horticultural Research Station, Ambalavayal. ..	"
12.	Sri.Bhaskaran Nambiar, Associate Professor, Coconut Research Station, Nileshwar. ..	"
13.	Sri.A.E.S.Kurup, Associate Professor, Rice Research Station, Kayamkulam. ..	"
14.	Sri.A.I.Thomas, Associate Professor, Directorate of Extension Education, Kerala Agricultural University. ..	Co-ordinator.

...

Participation in the Indian Council of Agricultural Research Golden Jublee Celebration.

Interdisciplinary team for the transfer of Technology for the improvement of the economic well-being of 500 marginal farmers and landless labourers:

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   Kerala Agricultural University,
   Vellanikkara.
2. Dr.U.P. Bhaskaran,
   Director of Research,
   Kerala Agricultural University,
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   College of Horticulture,
   Vellanikkara
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    Station, Odakkali.
13. Sri.T.F.Kuriakose,
    Associate Professor,
    Rice Research Station,
    Pattambi.
14. Dr.T.V.Viswanathan,
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    Rice Research Station,
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15. Sri.M.K.Mammen,
    Assistant Professor,
    Horticultural Research
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    Anakkayam.

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Coconut Research Station,
Nileshwar.

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Pepper Research Station,
Taliparamba, Cannanore Dist.

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Assistant Professor,
Communication Centre,
Mannuthy.

26. Sri.K.C.Varghese,
Assistant Professor,
Communication Centre,
Mannuthy.

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Fodder Research and
Development Scheme,
Mannuthy.

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College of Horticulture,
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45. Dr.N.Krishnan Nair,
Assistant Professor i/c
Pineapple Research Station,
Vellanikkara.

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P.R.O. i/c , Kerala Agricultural
University, Vellanikkara.

48. Smt.G.Padmakumari,
Assistant Professor,
National Demonstration Scheme,
Vellanikkara.

LAB TO LAND - MANUAL

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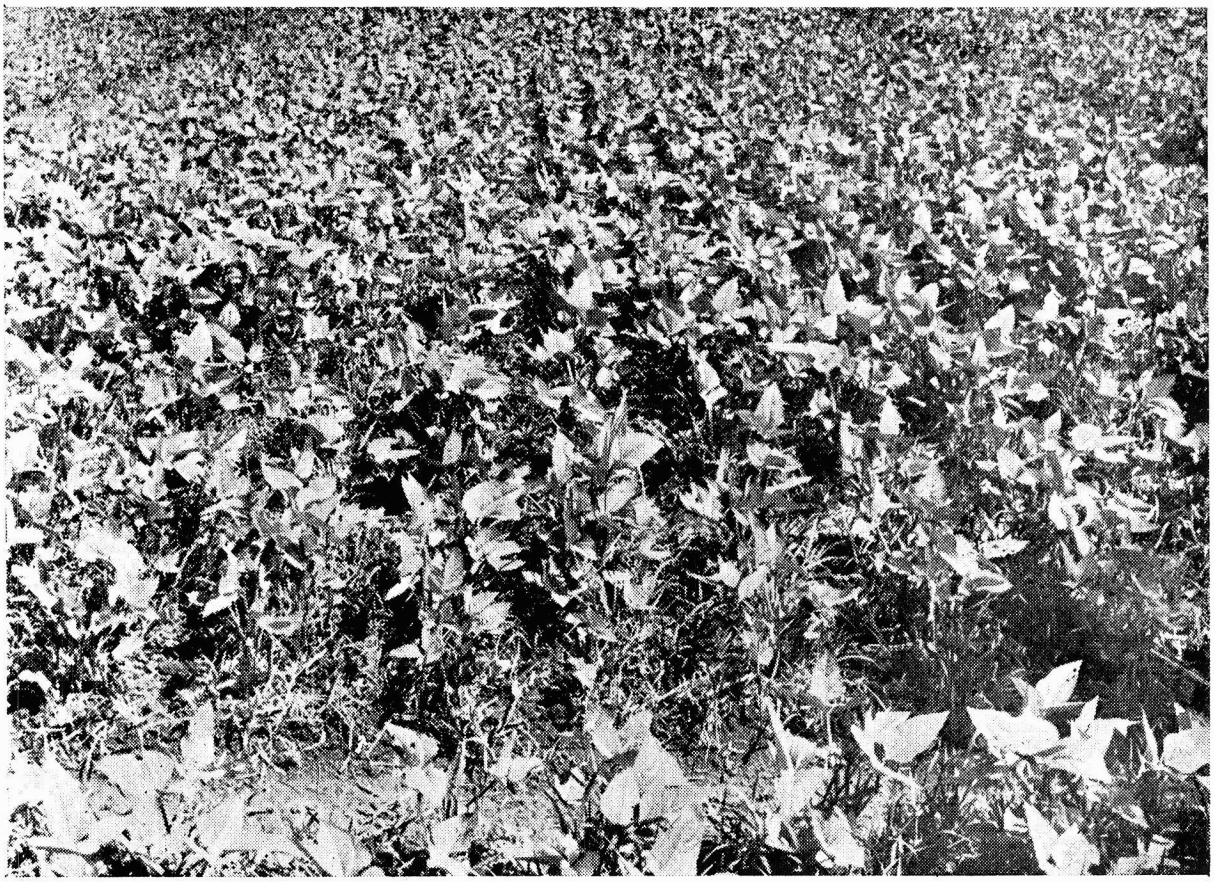
24.	Technical bulletin in cultivated crops in Malayalam	Sri.K.C.Varghees, Assistant Professor, Communication Centre, Mannuthy.	24:01

(1) Title of Technology	Appropriate technology for cultivating latest high yielding varieties evoloved Suvarna modan rice(ARC11775)
(2) Experimental evidence	Studies conducted in the rice research station Pattambi and farmers holdings in the districts of Trichur,Malapuram and Palghat indicated, Suvarna modan (ARC11775) assures stable 'modan' rice yields contrary to the popular varities Kattamodan (Ptb 28) Karthamodan (Pth 29) chuvanna modan (Ptb30). This tall variety introduced from Mizoram hills is non-lodging having to lerance to drought is early or late stages of crop growth. The variety provides sufficient long good straw to marginal farmer for feeding the cattle. In different locations and in many seasons this variety exhibited high degree of resistance to blast. The grain having white Kernel is medium slender and cooking quality good.
(3) The improvement expected after following the Technology by the selected Marginal farmer.	The marginal farmer can expect stable 'Modan' yields since yields levels have not been effected by the vagaries of season.
(4) The procedure to be followed or the package of practice to be follow	Similar 'modan' cultivation practices adopted by the farmer can be followed. However, he may be educated the need to use appropriate seed rates namely (80kg-100kg/ha) and the fertilizer recommendation of NPK at the rate of 60:30:30 respectively for realizing economic returns.
(5) Infrastructure required by the farmer	None at present.
(6) Availability of the inputs	Suvarna 'modan' seed is available in the Rice Research Station, Pattambi. Fertilizers required are available in the local markets freely.
(7) Cost involved in the adoption of the technology by each farmer	About Rs.50/- to Rs.60/Rs will be the additional cost while growing this variety. The increase is due to cost of good seeds and inorganic fertilizers required over and above, the local manures namely wood ash, powdered cattle manure etc. generally used for modan cultivation.
(8) Remarks	Nil.



Cultivation of Kanakamani Pulses

1. Tiele of the technology: Cultivation of Kanakamani cowpea.

Among the cultivated pulse crops in Kerala, Cowpea is the most important because of its adaptability to varied soil and climatic conditions. It is cultivated in all the seasons viz. Khariff, Rabi and Summer and occupy an area of 14,600 hectares out of the total area of 38,560 hectares of Pulses in this state. The average yield of cowpea is very low in Kerala when compared to other states, the per hectare Production being only about 250 kilogram per hectare. Shy bearing nature of the traditional varieties, inadequate manuring total neglect on Pest and disease control and other management Practices are only few reasons for such a low Productivity of this Protein rich food crop.

2. Experimental evidence:

With the objective of evolving a Photo insensitive high yielding short duration cowpea variety for Kerala extensive germplasm collections of indegeneous cowpea varieties were made between 1964 and 1966 from all the districts of Kerala. From the large number of germplasm collections thus obtained a variety collected from Kunnamkulam area of Trichur district was found to be Promising. This culture isolated by Pureline selection was found to give consistently higher yield in the yield trials. After rigorous evaluation of its Performance in different Parts of the State this variety (PTb-I cowpea) was approved by the state varietal release committee for large scale cultivation in Kerala. Named as "Kanakamani" (Kanakam means 'gold in Malayalam) the formal release of this variety was made on the 21st of December 1977 on the occasion of the Golden Jubilee Celebrations of the Rice Research Station, Pattambi.

"Kanakamani" is a medium duration, bushy, moderately high yielding dual purpose cowpea variety. The crop comes to harvest within 75-80 days during kharif season and 65-70 days during rabi and summer season if it is grown for grain purpose. If the crop is raised for vegetable purpose harvest can start on 55th day and can prolong upto 90th day. The average number of days taken for 50 Percent flowering is 48. This variety is Photoinsensitive and to an extend drought tolerant. Regarding the quality characteristics of this variety it is excellent as a green vegetable and equally good as Pulse (grain) type. The Protein content of this new variety is 22.41 Percent. As green vegetable, Pods of 'Kanakamani' have less fibre content and are more Palatable. Regarding yield Potential of (Kanakamani' it has outyielded 'New Era' one of the established variety of cowPea in Kerala - and can yield upto 1100 kilograms of grain or 2,500 to 3,500 kg of green Pods.

Yield data of PYB-1 cowpea in comparison with 5 promising varieties of cowpea (Yield in kg/ha)

Sl. No.	Varieties	1974-75	1975-76	1976-77	Pooled yield (mean of 3 years)
1.	New Era	102	725	181	336
2.	Pusa Dofasli	81	481	514	352
3.	Pusa phalguni	156	525	428	369
4.	Pusa Bursati	101	536	802	479
5.	P-118	161	922	868	650
6.	PYB-I (Kanakamani)	252	1197	853	768
C.D.5%			270	302	130

3. Improvement expected after following the technology by the selected marginal farmer:

Since majority of Kerala's population consume cowpea as green vegetable, cultivating this dual purpose cowpea variety in homestead gardens round the year will improve the farmers' revenue and also improve the fertility of the soil. At present the average yield of grain type of local cowpea varieties is only 300 kg/ha. Cultivation of local varieties may not bring much profit to the farmer. If the improved variety is used, an additional yield of 200 kg/ha can be expected which will bring profit to the small farmers. If the produce is harvested as green pods this profit will be much more.

4. The Procedure to be followed or the Package of Practice to be followed by the farmer:

Plough the land 2-3 times and remove weeds and stubbles. Channels are drawn at 2 metre apart 30 cm broad and 15 cm deep to drain off excess rain water. If dibbling method of sowing is adopted a spacing of 30 cm. between rows and 15 cm between plants is recommended with 2 seeds per hole. If broadcast method is adopted the entire field can be sown broadcast over the field and channels drawn after sowing. Seeds can be treated with Rhizobium culture before sowing.

Manures and fertilisers

Lime	-	250 kg/ha
N	-	20 kg/ha
P_2O_5	-	30 kg/ha
K_2O	-	10 kg/ha

Lime can be applied at the time of first ploughing. Half the quantity of nitrogen, whole of P2 O5 and K2 O are applied at the time of final ploughing. The remaining nitrogen can be applied 15-20 days after sowing as 3% urea solution as foliar spray.

After cultivation:

Hoeing at the time of application of second dose of nitrogen will help to give adequate aeration to the soil and help the root system to spread easily. During the Kharif season and under good soil moisture condition when the crop shows trailing tendency, decapitation is found to be advantageous.

Plant Protection:

Spray Lebaycid 500 ml/ha if the crop is grown for vegetable purpose and carbaryl 0.2% if grown for grain purpose so as to protect the crop from pod borers. Repeat the application if infestation persists.

Harvesting:

Harvesting of green pods can be made at 10 days interval. Even if the crop is grown for grain purpose harvesting of the first set fruits as green pods was found to enhance prolonged flowering and long duration of the crop.

5. Infrastructure required by the farmer:

1) Good piece of land.
2) Irrigation facility - A tank with some water lifting devices.
3) Plant protection equipment - A knapsack sprayer.
4) Marketing facility to seel the green pods of cowpea produced.

6. Availability of the inputs:

1) Good quality seeds of PTB-I (Kanakamani) Cowpea - 700 kg
2) Rhizobium culture
3) Advice by Research personnels.

7. Cost involved in the adoption of the technology by each farmer:

1) For cultivating 1 ha. of PTB-I Cowpea for vegetable purpose.	:	Rs.2290/-
For a marginal farmer of area 0.37 Acres (1480 sq.mt.)	:	340/-
Income	:	444/-
Profit	:	Rs. 105/-

2. For grain Purpose

For a marginal farmer of area 0.37 acres(1480 sq.m.): Cost of Production		Rs.362/-
Income	:	444/-
Profit	:	Rs. 81/-

8. Remarks:

When local cowpea varieties are cultivated no fertilizers or Plant Protection chemicals are used by farmers. By transfering this technology viz., "Cultivation of Kanakamani Cowpea" to marginal farmers, it will be Possible to create an awareness on the importance of improved varieties and the role of adoption of Package of Practices for successful Pulse cultivation in Kerala.

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Cultivation OF Panniyur I

1. Title of Technology: Cultivation of Panniyur-1 variety of Pepper.

2. Experimental evidence: Panniyur-1, a hybrid variety of pepper has been found to have an yield potential as high as 2-4 times more than the local varieties of pepper under proper management practices. However, it has been found that the performance of the hybrid variety is not quite satisfactory under heavy shade.

Considering the high yielding nature of Panniyur-1, the Department of Agriculture had taken up the multiplication and distribution of rooted cuttings of the variety. The programme that was started a few years back has now expanded considerably, and more than ten lakhs of cuttings are being distrubuted annually at present. Even so, only a small percentage of the cultivators' demands are being met and this is sufficient proof for the popularity of the variety among cultivators.

3. The improvement expected after following the technology:

Growing Panniyur-1 variety of pepper on all suitable trees and in the available interspaces will substantially increase the income from the holdings without much additional expenses.

4. The package of practices to be followed by the farmer:-

Pepper can be grown as a pure crop, Intercrop or companion crop in gardens situated at sea level to an altitutde of 1200M. above MSL. The crop requires a well distributed rainfall of 250cm. per annum or more. Atmospheric temperatures below 15° C and above 40 C are not favourable. The soil should be rich in humus and well drained. Water logging in the soil at any time should be strictly avoided. Pepper can be grown in soils with a minimum depth of 1M.

The variety Panniyur-1 should be planted in all gardens without much shade. In heavilly shaded gardens it is preferable to plant one of the local popular varieties such as Karimunda, Kottanadan, Balankotta or Kalluvally.

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When grown as a pure plantation, standards of Erythrina Indica, Garuga Pinnata or other suitable plants should be planted at a distance of 3 x 3 M. Pits of size 30 x 30 x 30cm. should be prepared on the northern side of the standard, 15 cms. away. Fill the pits with a mixture of well rotten cattle manure and top soil. At the onset of S.W. Monsoon (June-July), plant pepper cuttings in these pits 30cm. away from the base of the standard. Two rooted cuttings may be planted per pit. Press the soil around the cuttings well, to prevent water stagnation. It is desirable to form a small mound of soil (radius about 30cm) around the plants to prevent water logging during heavy rains. Provide shade to the plants during the first two years in summer. The soil at one meter radius around the plants should be dug twice in an year with the onset of S.W. Monsoon, and at the end of N.E. Monsoon. Earthing up may be along according to necessity Mulching the basins with dry leaves may be done duringsummer. Tying vines to the standards and shade regulation may be done whenever necessary. Soil conservation measures may be adopted on sloppy terrains.

100g. N, 40g. P_2O_5 and 140g. K_2O per plant per year is the fertiliser recommendation. This should preferably be applied in two split doses in May-June and Augugst-September. Only 1/3 of the above does should be applied in the first year and 1/2 the dose during second year. Over and above the fertilisers, 10kg cattle manure/compost/green leaves should be applied per plant per year at the onset of rainy season.

Plant protection measures may be adopted according to necessity.

5. Infrastructure required by the farmer:- Nil.
6. Availability of inputs: Rooted cuttings of pepper are available from various sources like Department of Agriculture, Kerala Agricultural University etc.
7. Cost involved for adopting the technology: The total cost involved will be Rs. - to 5/- per plant per year.
8. Remarks: An average yield of 1-2 kg. dry pepper per plant per year can be expected from the 4th/5th year.

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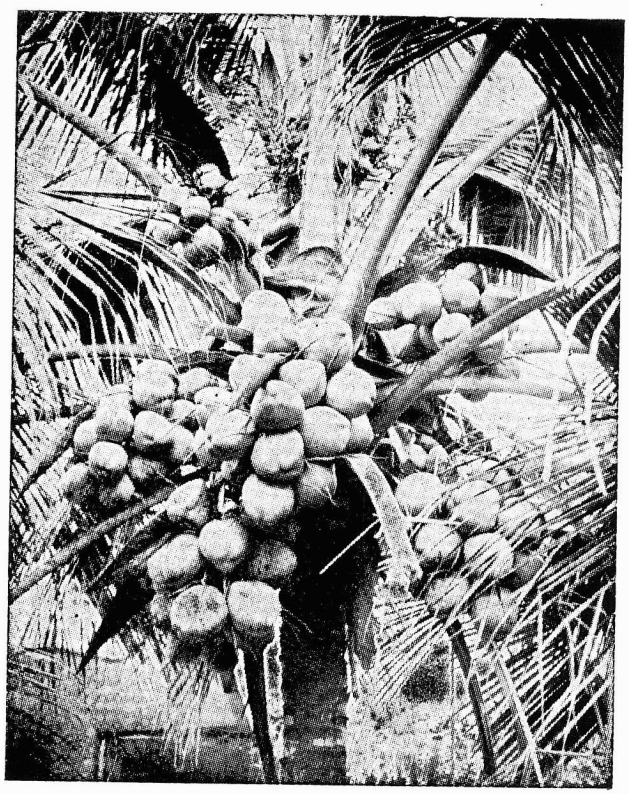


Hybrid Coconut

1. Title of the Technology: Cultivation of Hybrid Coconut.

2. Experimental evidence:

Studies conducted at the Coconut Research Station, Nileshwar during the last 4 years have unquestionably established the superiority of Hybrid Coconut over local Tall in respect of early fruiting and annual yield (Ref. Coconut convention, KAU, 1975).

3. Improvement expected after following the technology by the selected marginal farmer:

Studies conducted so far have proved that the increase in yield is over 50% that of the local Tall variety.

4. The Procedure to be followed or the Package of Practices to be followed by the farmer:

It is suggested that the marginal farmer may remove all those uneconomic Palms and Plant with hybrid seedlings. Vacant areas may also be Planted with this hybrid variety. The yield Potential of the existing Palms (Tall) may be increased by adopting the various agronomic practices and plant protection measures enumerated in the "Package of Practices". Whenever facilities for irrigation during summer exist the same should be made use of to increase the yield still further.

5. Infrastructure required by the farmer :

Detailed informations regarding the successful and economic cultivation of hybrid coconut should be clearly brought home to the cultivators. They should be well informed about the method of planting, after care of young seedlings, manurial schedule and its applications, beneficial effects of irrigations during summer and the necessity of taking adequate and timely plant protection measures.

6. Availability of the inputs:

In the case of marginal farmers, availability of organic manure such as cattle manure or compost may not be a problem as each of the home steads would invariably be maintaining few livestock. The only problem will be to make available the required quantity of fertilizers/fertilizer mixtures at the appropriate time.

7. Cost involved in the adoption of the Technology by the farmer:

The initial cost of planting and maintenance charges thereafter upto 7 to 8 years, when the hybrid palms attain regular and normal bearing stage, would be Rs.120/- for each plant. Annual maintenance charges thereafter would be approximately Rs.15/- per palm. Calculating on an average of 80 nuts per tree per year the income works out to Rs.80/- and the net return per tree will be Rs.65/-. In the case of ordinary tall, the average yield is estimated at 40 nuts per tree per year and the anticipated net return to be only Rs.25/-.

8. Remarks:

Taking up the planting of hybrid coconut seedlings for the future would be most beneficial to the marginal farmers in terms of economic returns.

1. Title of the technology: Scientific cultivation and processing of East Indian Lemongrass (C.flexuosus) Variety OD-19.

Economic holding: 3 hectares considering the full utilisation of one distillation unit.

Based on the experimental results obtained at Lemongrass Research Station, the following package of practices are to be adopted.

1. Nursery:

Area	:	Raised beds in 1000 sq.m.
Seed rate	:	10 kg. per hectare.
Time of sowing	:	End of April
Watering	:	Twice in a day for a week and for the remaining period as and when required.
Mainfield	:	Raised beds in sloppy area. size - 80 cm width and of convenient length.
Manuring	:	As basal application 2½ tonnes of compost and 2 tonnes of wood ash. This is to be repeated every year after the harvest and weeding and followed by earthing up.
Transplantation	:	1½ to 2 months old seedlings are transplanted at the rate of 2 seedlings per hill at a spacing of 15 cm x 10 cm depending on the fertility of the soil.
Weeding	:	Efficient weeding to be done during first year. In subsequent years weeding once or twice are to be adopted depending on the weed infestation.
Harvesting	:	First harvest starts 3 months after planting. Subsequently at 50-60 days interval.
Distillation	:	Water and steam method. The cut material to be wilted under shade for 2 to 3 days depending upon the season for getting

maximum oil recovery. Distillation time - 2 hours including loading and unloading of the material.

Rectification of oil and Storring. : Oil should be free from sediments and water drops. This can be achieved by keeping the oil for a day and then by decantation. Oil should be stored in Aluminium or Coloured glass containers.

Quality of Oil : Oil containing 80% citral is graded as A and a premium price will be obtained for higher citral content. Oil from OD-19 contain 85-90% citral.

Economics (Capital expenditure excluded) : Expenditure for one hectare for 5 years (economic growth period)

Rs.22,000/-

Receipt from oil - 390 kg. @ Rs.70/- per kg (Rate at Cochin market) - Rs.27,300/-

From spent grass - 100 tonnes @ Rs.30/- per ton - Rs.3,000/-

Total Rs.30,300/-

Profit - Total Rs.8300/- or Rs.1260/- per year.

N.B:- Soil & Climate: Sandy loam or laterites is best. Good sunlight and distributed good rainfall (250 cm. per year) are essential for its optimum oil production. Cultivation under shade will reduce the oil and citral content. Water logging condition should be avoided.

Title of the technology : Scientific cultivation and processing of Palmarosa (C.martini, Variety Motia).

Economic holding : 3 hectares considering the full utilisations of one distillation unit.

Based on the experimental results obtained at Lemongrass Research Station, Odakkali, the following package of practices are to be adopted.

Cultivation practices:

Nursery

Seed rate : 12½ kg per hectare.

Area : Raised beds in 1000 sq.m.

Time of sowing : End of April.

Watering : Twice in a day for a week and for the remaining period as and when required.

Mainfield : Raised beds in slopy area. Size - 80 cm. width and of convenient length.

Manuring : As basal application 6 tonnes of compost and 2½ tonnes of wood ash.

This is to be repeated every year after the first harvest and weeding and followed by an earthing up.

Transplantation : 1½ to 2 months old seedlings are transplanted at the rate of 2 seedlings per hill at a spacing of 30 x 20 cm.

Weeding : Efficient weeding is to be done during first year. In subsequent years weeding twice have to be done.

Harvesting : The grass is harvested one week after flowering. Generally two harvests are made during the first year of planting. From second year onwards 3 to 4 harvests can be made.

Distillation : Water and steam method. The cut material is to be wilted under shade for 24 hours before distillation during monsoon season and 48 hours during the post-monsoon season for getting maximum oil recovery.

Distillation time - 2 hours including loading and unloading of the materials in the still.

Rectification of oil and storing. : Oil should be free from sediments and water drops. This can be achieved by decantation after keeping the oil from a day. Oil should be stored in Aluminium or coloured glass containers.

Quality of Oil : Palmarosa oil should contain 88 or above percentage of geraniol for export quality.

Economics (capital expenditures not included) : Expenditure for one hectare for 5 years (economic growth period):

	Rs.21,000/-
Receipt from oil-250 kg @ Rs.150/- per kg.	37,500/-
From spent grass - 65 tons @ Rs.30/- per ton	1,950/-
Total	39,450/-
Profit - Total	Rs.18,450/- of Rs.1845 per year.

Soil & Climate: It requires more fertile soil compared to the soil for lemongrass. Well drained loamy soil is the best. It prefers tropical climate and open conditions.

1. Title of the technology: FIFTEEN POINT STRATEGY FOR REDUCING COST OF CULTIVATION OF RICE.

2. Experimental evidence:

1) Grow a green manure crop like daincha in April-May in areas where the Virupu crop is usually transplanted:

Raising green manure crop and incorporating the same in the field has been found to increase the rice yield varying from 18-50 percent. A green manure crop of daincha raised during April-May will be ready for incorporation by June-July. Application of phosphatic fertilizers through a green manure crop has been found to be more efficient than its direct application to the rice crop. The advantage of green manuring practice is illustrated under Table-1.

TABLE - I

AVERAGE YIELD OF PADDY IN LB PER ACRE WITH AND WITHOUT GREEN MANURING

Green manure crops at different places	Yield of paddy in lb./acre		Increase of paddy in lb./acre	Percentage increase over control.
	Control	Green manure		
Daincha	1840	2296	456	25
Sunhemp	1840	2184	344	19
Daincha	2082	2464	382	18
Daincha	1508	2277	769	51

2) Puddle and level the field thoroughly:

Percolation of irrigation water and lose of plant nutrients can be reduced by puddling the field thoroughly. Proper puddling destroy all the weeds. The water will stand uniformly in levelled fields. As a result, subsequent germination of weed seeds is controlled and growth of weeds is checked.

3) Raise medium duration varieties as far as possible:

It has been observed that the yield of short duration varieties is always lower than the medium duration varieties. It is therefore specially recommended to raise medium duration varieties during both the crop seasons so as to secure maximum grain yield.

T A B L E - 2

Grain yield in kg hectare of medium and short duration varieties during the two season

Month of planting		Medium duration			Short duration		
		Jaya	IR-8	Aswathy	Rohini	Triveni	Annapurna
June	Viruppu	4756	4050	4078	3120	2857	3036
July		5476	4920	4947	4650	4050	3378
	Mean	5116	4485	4513	3885	3454	3207
September	Mundakan	4179	4660	3950	1871	3513	3865
October		3905	3776	3714	2986	3625	3580
	Mean	4042	4218	3832	2429	3569	3723

4) Maintain optimum plant density per unit area:

Results of spacing trials conducted have shown that a spacing of 20 cm x 15 cm to provide a population density of 33 hills per sq.metre during the Viruppu season and 20 cm x 10 cm to accommodate 50 hills per sq.metre during the Mundakan season for the medium duration varieties have been found to give maximum grain yield. But the early duration varieties like Triveni and Annapoorna, a plant density of 67 hills per sq.metre by adopting a spacing 15 cm x 10 cm during both the seasons would give the best results.

5) Plant the seedlings shallow (3-4.5 cm), as shallow planting increases the tillering potential of seedlings.

Studies conducted at the Rice Research Station, Pattambi with dwarf indica (high yielding varieties) have indicated the influence of depth of planting on tillering. The seedlings planted at 1.5 and 3 cm deep produced significantly more number of productive tillers per hill as compared to those planted very deep. The tillers put forth by seedlings planted at 6.0 and 7.5 cm were more compact and erect in contrast to the shallow planting. Maximum grain yield was recorded by seedlings planted at 3.0 cm in the first season and 4.5 cm during the second crop season. These studies indicated that the shallow planting ie., 3.0 cm to 4.5 cm is preferable to deeper or too shallow planting.

6) Control the weeds during the vegetative phase itself. One weeding thoroughly on the 30th day after sowing is ideal. Use herbicides for weed control wherever possible as it is cheaper than hand weeding.

Studies on the relationship between the weed free condition of the field and the critical time of weeding on the yield of rice have shown that the weed growth should be removed from the field within 30 days of planting for minimum yield loss. The data under Table-3 illustrate the importance of timely weeding.

TABLE - 3

The effect of weed free condition and the time of weed removal on rice yield.

	Treatment		Yield of grain kg/ha.	Dry weight of weeds kg./ha. at harvest.
		No.of days		
1.	Control (No weeding)		2206	5414
2.	Weed control upto 15		3467	2624
3.	-do-	30	3838	1103
4.	-do-	45	3964	449
5.	-do-	60	3885	473
6.	-do-	75	3861	355
7.	-do-	90	4176	331
8.	Weed control on the 15		3097	3254
9.	-do-	30th	3201	1237
10	-do-	45	3310	788
11.	-do-	60	3152	473
12.	-do-	75	2758	370

It may be seen from the above table that the field should be maintained weed free by weeding at least before 30th day of planting to secure the highest yield.

In case of chemical weed control the following methods may be adopted.

(i) Apply Propanil (Stam F-34) at 5 litres/hectare in 3% fresh urea solution (100-125 litres) per hectare as spray 12-14 days after transplanting.

(ii) Machete 5% granules at 20kg/hactare six days after transplanting.

(iii) Whereever broad leaved weeds are pre-dominant, apply 2, 4-D at 1kg/ha. in 400 litres of water 25 days after transplanting.

7. Under good management Practices (vide item 1-6) reduce the dose of nitrogen fertiliser to half the present recommended levels. Apply the fertilizer when the Plant is able to make the best use of it at tillering and seven days before panicle initiation.

In case the management practices suggested under items 1 to 6 are followed, the present recommended dose of 90 kg of nitrogen can be reduced almost half as can be seen from the Table-4, without any detrimental effect on the grain yield.

Table - 4

Grain yield of rice in kg/ha. under different doses and schedule of nitrogen application.

Tr No.	Percentage of Nitrogen applied				Total Nitrogen applied kg/ha	Grain Yields kg/ha. 1974-75		1975-76	
	Plant-ing	10DAT	30DAT	P I		I Crop	IICrop	ICrop	IICrop
1	50	--	25	25	100	3574	3347	3509	2404
2	--	50	25	25	100	3260	3242	3860	2271
3	37.5	--	18.75	18.75	75	3248	3256	3704	2349
4	--	37.5	18.75	18.75	75	3423	3529	3743	2377
5	25	--	12.5	12.5	50	3451	3353	3743	2271
6	--	25	12.5	12.5	50	3360	3242	3548	2053
7	No Nitrogen P_2O_5 and K_2O Only					3306	2853	2963	2104
8	No manure					2554	2918	3002	1792

Note : DAT - Days after transplanting.
P I - Panicle Initiation.

8. When the field preparation and planting are done on rainy days (Viruppu season) postpone the application of basal dose of nitrogen to the early tittening stage.(10 days after planting).

In order to obtain maximum nitrogen use efficiency by reducing loss of nitrogen through seepage and run off, it is recommended to postpone the application of the basal dose of nitrogen to 10 days of planting, in case transplanting heppebs to fall on heavy rainy days.

9. Under the limited availability of nitrogen apply it 7 days before panicle initiation. It is the bbest time of topdressing.

Under resource constraints, the quantity of nitrogen proposed to be applies is limited, it is best done 7 days before panicle initiation in the better advantage. The results of the trial under this aspect is illustrated under Table - 5.

Table - 5

Mean grain yield of two varieties as influenced by time of application of nitrogen.

Tr No.	Time of application of Nitrogen kg/ha. Planting	Tillening	7 days before P I	P-I	Total Nitrogen kg/ha.	Mean grain yield of two varieties kg/ha.
1	---	---	---	---	---	2418
2	50	---	---	---	50	3010
3	--	50	---	---	50	3084
4	--	--	50	--	50	3354
5	--	25	25	--	50	2956
6	--	25	--	25	50	3037
7	25	25	--	--	50	2029
8	25	--	25	--	50	3192

The mean grain yield of varieties was observed to be maximum when 50 kg of nitrogen was completely top dressed 7 days before panicle initiation.

10. Adopt agronomic practices for increasing nitrogen use efficiency.

(a) Application of nitrogen in the reduced zone is better utilised by rice crop for grain production. This is illustrated under Table-6.

Table - 6

Grain yield of rice in kg/ha. as influenced by methods of application.

Tr No.	Dose of Nitrogen kg/ha	Mode of application	Grain yield kg/ha
1	0	---	2770
2	28	Split broadcast	3309
3	28	Placement as mudballs	3327
4	28	Placement as briquets	3192
5	28	Incorporated as SCU	3372
6	56	Split broadcast	3462
7	56	Placement as mudballs	4163
8	56	Placement as briquets	3714
9	56	Incoporated as SCU	3912
10	80	Split broadcast	3804

Note : SCU - Sulphur coated urea.

(b) Incubating urea with moist soil for 24 hours in the proposition of 1:5.

Incubating Urea with moist soil for 24 hours aids in the conversion of amide form of nitrogen into ammonical form. Ammonical form of nitrogen is readily obsorbed by the rice plants and there by the loss of nitrogen is kept under minimum.

(c) Blending Urea with neem cake.

The effect of neen cake coated urea on the yield of rice is illustrated in the Table-7. It may be seen that neem cake blended urea recorded the highest yield of grain. Well powdered neemcake is to be mixed with urea, in the proposition of 1 part of cake to 5 part of urea by weight. This mixture may be applied after draining the field.

Table-7

Grain yield of rice as influenced by Urea applied along with nitrification inhibitors.

	Treatments	Grain yield (kg/ha.)
1.	Urea	2688
2.	Sulphercoated Urea	3712
3.	Shellac coated Urea	3674
4.	I BDU	3402
5.	Neem cake blended Urea	4296

11. Choose Cheaper Fertilizer materials.

Nitrogen application in the form of urea is cheaper than the nitrogen through ammonium sulphate. Likewise, the application of P_2O_5 in the form of Mussorie rock phosphate is cheaper than Super Phosphate and therefore considerable economy in the price of the nutrients can be achieved.

12. Apply phosphatic fertilizer once in two seasons in areas where there is no marked response to phosphorus.

13. Apply potash once in two seasons in arears where there is no marked response to potash.

The studies conducted on the possibilities of skipping P and K have given clear evidence to substantiate the above recommendations. The results under Table-8 show that in soils where P and K application had no response, these two nutrients could be skipped over for one or two seasons without considerable decline in grain yield.

Table -8

	Virippu	Mundakan	Virippu	Mundakan	Virippu	Mundakan
1	N P K	N P K	N P K	N P K	N P K	N P K
2	N P K	N -- K	N P K	N - K	N P K	N - K
3	N - K	N P K	N - K	N P K	N - K	N P K
4	N P K	N - K	N - K	N P K	N - K	N - K
5	N - K	N P K	N - K	N - K	N P K	N - K
6	N P K	N P -	N P K	N P -	N P K	N P -
7	N P -	N P K	N P -	N P K	N P -	N P K
8	N P K	N P -	N P -	N P K	N P -	N P -
9	N P -	N P K	N P -	N P -	N P K	N P -
10	N - -	N - -	N - -	N - -	N - -	N - -

Skipping P or K, according to position.

Grain Yield kg/ha.

	1974-75		1975-76		1976-77	
	Virippu	Mundakan	Virippu	Mundakan	Virippu	Mundakan
1	3511	3223	3538	2581	2262	2127
2	3560	3042	3758	2271	2615	2458
3	3643	3144	3605	2337	2548	2524
4	3566	3276	3406	2138	2249	2293
5	3346	3267	3638	2337	2637	2623
6	3649	3210	3638	2249	2482	2480
7	3467	3056	3781	2083	2328	2403
8	3566	3236	3627	2194	2372	2315
9	3616	3267	3649	2315	2535	2469
10	3538	3329	3263	2017	2328	2260

14. Adopt timely control measures against insect pests and diseases.

Timely control measures against insect pests and disease based on surveillance methodology will go a long way in securing the normal yield of grain at the same time reducing cost of Plant Protection.

15. Harvest the crop at optimum moisture content.

Harvesting the crop at the correct stage would avoid loss due to shedding. The optimum moisture percent for harvesting of the crop has been found to be 18 to 24 percent. This would also improve the milling recovery of head rice.

III. The improvement expected after following the Technology by the selected Marginal farmer.

By adopting the 15 point strategy explained above the cost of cultivation can be reduced to an extent without sacrificing the field.

IV. Procedure to be followed

The farmers are to adopt the appropriate technology suitable for their condition.

V. Infrastructure required by the farmer.

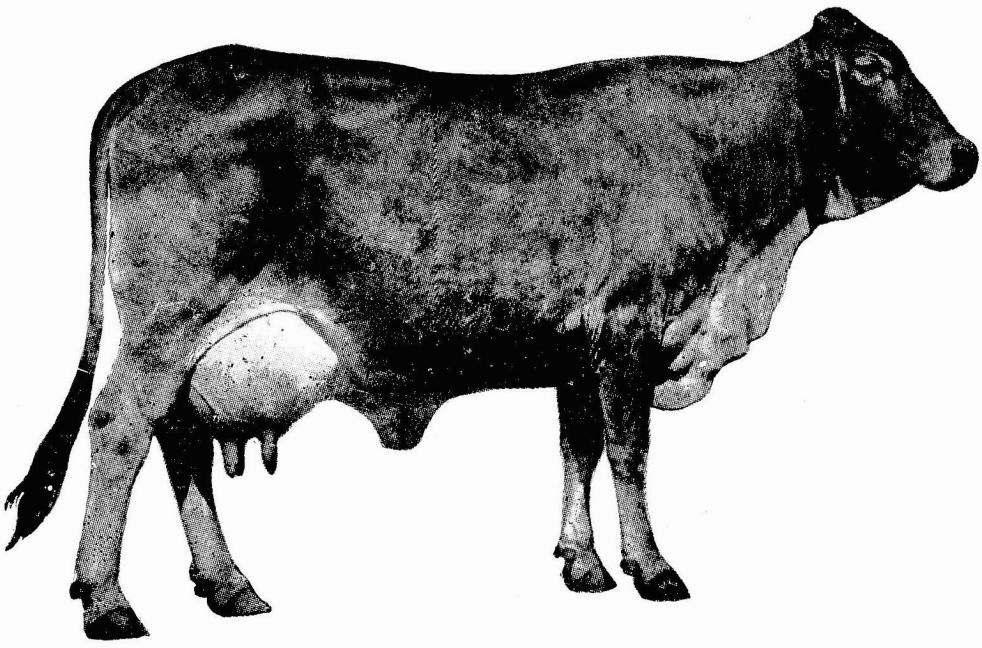
(i) Daincha seeds during April-May at the rate of 30-40kg/ha. Rs.80/-
(ii) Stam F-34 5 litre/ha Rs.150/-
(iii) Neem cake.

VI. Availability of the inputs:

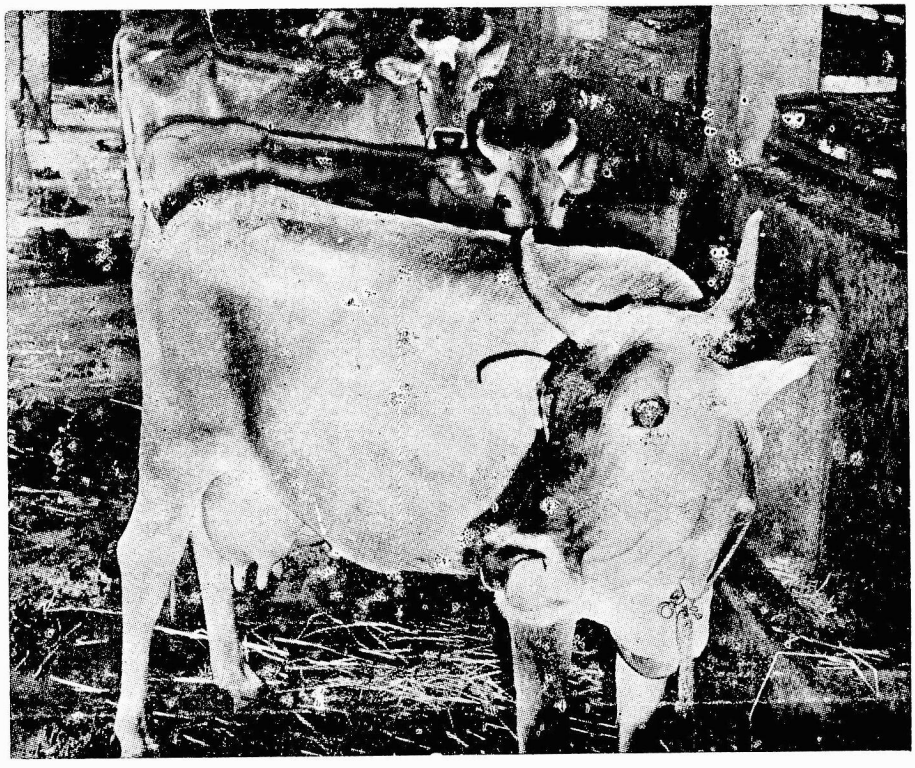
All the inputs required are readily available in the market.

VII. Cost involved in the adoption of the Technology by each Farmer.

This depend on the technology or technologies followed by the individual farmer.



Cheaper cattle feed formulated for cattle rearing farmers



1. Title of technology: Cheaper feed formulated for cattle for adoption by farmers.

2. Experimental evidence:

Attempts have been made in the Department of nutrition, College of Veterinary and Animal Sciences, Kerala Agricultural University to identify cheap and locally available agricultural or industrial bye-product feeds, for incorporation in the cattle rations. Several such feeds have been analysed for their proximate principles and some of them have been tested through animal experimentations. The results of these studies indicate that many of these unconventional feeds can be profitably incorporated in the concentrate feeds of cattle at varying levels, without any adverse effect. Though many of these bye-product feeds are available only in certain areas of the state or in certain seasons, the farmers can make use of them for home mixing of rations wherever possible. Cheaper feed formulae incorporating only four of the promising bye-product feeds available in plenty in our state, are proposed for adoption by farmers. These bye-products feeds are (1) Rubber seed cake (2) Tapioca starch waste (3) Silk Cotton seed and (4) Tapioca leaf meal.

3. The improvement expected after following the technology by the selected marginal farmers:

The farmer will be benefited by reducing the cost of feeding of animals by about 20%, if these cheap feeds are mixed at the home premises. Rubber seed cake and tapioca starch waste can be obtained from market and the tapioca leaf meal and silk cotton seed can be procured locally by the farmer.

4. Procedure to be followed or the Package of Practices to be followed by the farmer:

The following bye-Product feeds are recommended to be incorporated in the ration mixture by the farmer upto the levels set by experiments carried out.

		Level of feed in concentrate ration
1. Rubber seed cake	-	30%
2. Tapioca starch waste	-	25%
3. Silk cotton seed	-	20%
4. Tapioca leaf meal	-	30%

Typical ration formulae, incorporating one of the above feeds in each ration, are given below:

Ration-I		For 100 kg.feed
Rubber seed cake	-	30.00 kg.
Groundnut cake	-	22.00 kg.
Rice bran	-	25.00 kg.
Tapioca chips	-	20.00 kg
Mineral Mixture	-	1.5 kg
Salt	-	1.5 kg

Ration-II		
Tapioca starch waste	-	25.00 kg
Groundnut cake	-	30.00 kg
Gingilly oil cake	-	10.00 kg
Rice bran	-	32.00 kg
Mineral Mixture	-	1.50 kg
Salt	-	1.50 kg

Ration-III		
Silk cotton seed	-	20.00 kg
Groundnut cake	-	28.00 kg
Tapioca chips	-	24.00 kg
Rice bran	-	25.00 kg
Mineral mixture	-	1.50 kg
Salt	-	1.50 kg

Ration-IV		
Tapioca leaf meal	-	30.00 kg
Groundnut cake	-	30.00 kg
Tapioca chips	-	22.00 kg
Rice bran	-	15.00 kg
Mineral mixture	-	1.50 kg
Salt	-	1.50 kg.

5. Infrastructure required by the farmer — NIL

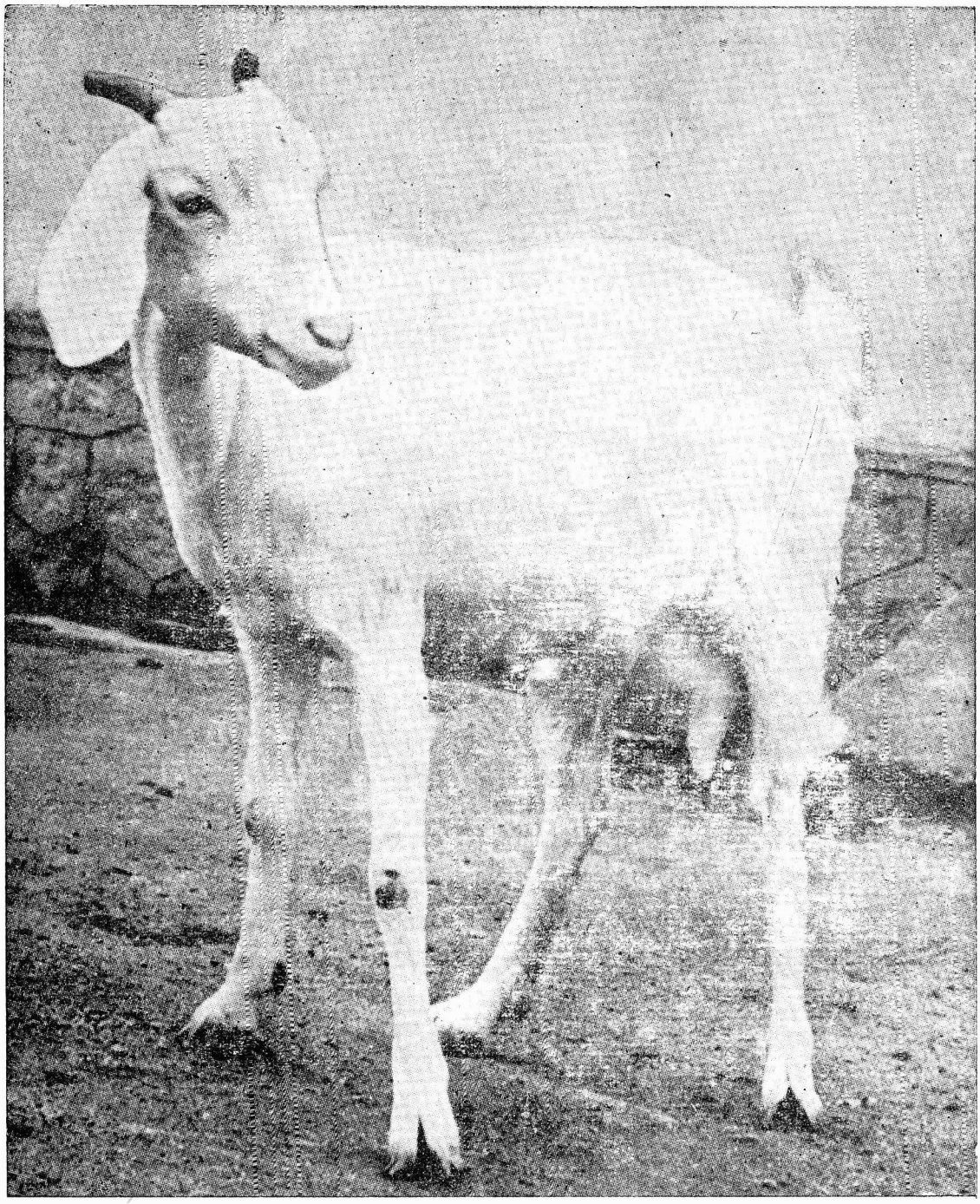
6. Availability of inputs:

Rubber seed cake and tapioca starch wastes are available in the rubber seed oil extraction factories and starch factories, respectively. They are available in the open market also. The Silk Cotton Seed and tapioca leaf meal are to be collected and preserved by the farmer at appropriate seasons when they are available.

7. Cost involved in the adoption of the technology by each farmer:

The cost of preparing the feed mixture will be available, but on the average cost of preparing the feed as per the above formulae will be about Rs.80-90 per 100 kg feed.

8. Remarks:



Multiplication of Goats for Milk Production

1. Title of Technology: Multiplication of Goats for Milk Production.

2. Experimental evidence:

The goat has for ages been a provider of milk, meat and valuable farm manure. It is not every farmer who can not afford to keep a milch cow. But with less capital investment and resources, even the poorest landless agricultural labourers can keep a goat or two to give some milk for the family and provide additional income by sale of kids. In the programme for improving the standard of living of the rural poor goat rearing can form an important aspect.

In Kerala, the well known breed of goat is Malabari/local goats. They were found to be poor milk producers. Over and above that they were also with poor growth rate. In the A.I.C.R.P. on Goats, at the Kerala Agricultural University, attempts were made to improve the production, growth and reproduction potential of goats in Kerala by cross breeding utilising superior exotic breeds of goats, Saanen and Alpine. The animals are bred by Artificial Insemination. The crossbred goats, Saanen x Malabari and Alpine x Malabari, showed better growth rate and also kidded earlier than local goats. Crossbred goats produced 3 to 4 times more milk in a lactation than local goats. The lactation length was also found to be higher in crossbreds.

Observations made so far x indicated scope for improving the milk production capacity of goats by introduction of exotic germplasm. In the villages around Mannuthy, (project centre) the farmer's goats are bred to the crossbred bucks. Under individual care and management in the farmers' homesteads, the crossbred goats perform much better than local goats and they fetch very high price.

The crossbred bucks were supplied to farmers, developing agencies and charity institutions of the state for breeding purposes and the reports from different parts of the state are encouraging.

The brief account furnished above show that there is great scope for developing the goat as a profitable milch animal in the villages and the multiplication of goats for milk production for the small farmers and Agricultural labourers is envisaged. Supply of crossbred bucks to different parts of the state for breeding purpose is envisaged.

3. The improvement expected after following the technology by the selected marginal farmers:

The crossbred bucks to be maintained for breeding purpose at different regions of the state are expected to produce number of goats with better genetic potential for milk production and growth rate. It is expected to make goats as much dairy animals as cattle by the application of suitable care and management practises. The milch goats will meet the milk requirements of the poor sections of the society and also will provide them with additional income through sales of kids, meat and manure.

4. Procedure to be followed or the package of practice to be followed by the farmer:

Crossbred bucks either Saanen x Malabari or Alpine x Malabari may have to be maintained by a progressive farmer in one locality. Bucks can also be maintained in the local Veterinary Institution or farmers' Co-operative Societies. In certain localities missionary institutions can also maintain cross bred bucks for breeding purpose. The services of those bucks can be made available to mate the does of local farmers. A buck can be used for serving 5 to 6 does per week. The institution may not levy any fee. But local farmer can levy nominal charge of Rs.3 to 4 per mating, for meeting the maintenance cost of a buck.

A female kid attains maturity by 12 to 15 months of age. The oestrus cycle in goats is with a duration of 21 days and the actual heat period is for 24 to 36 hours. Frequent lashing of the tail, bleating, tendency to mount other goats or allowed to be mounted by other goats and mucous discharge from the genitalia are the important signs of heat. The opportune time to mate a doe in heat is at the middle heat period. If the heat signs persist even after mating, there is no harm in mating it again. The gestation period in goats ranges from 145 to 152 days with a mean of 150 days. The doe ones bred if fails to come to heat again after 21 days it is an indication of concention.

A lean to shed with wooden platform covering an area of 10 to 12 sq.feet appears to be ideal for a buck shed. The buck may have to be fed 2.5 kg of green leaves and 1 kg of concentrate per day.

5. Infrastructure required by the farmer:

Purchase of a crossbred buck at Rs.417.60. Buck can be purchased by a progressive farmer or collectively by farmers of one area. Charitable institutions and development agencies also can purchase the bucks and

entrust to a farmer for maintenance. The farmer concerned has to make available the services of the buck for mating the does of farmers in the locality. Banks also can advance loans for the purchase of bucks. Levying of nominal charge/mating also is justifiable.

6. Availability of inputs:

The crossbred bucks are available for distribution at the A.I.C.R.P. on Goats for milk unit, Kerala Agricultural University, Mannuthy. Interested farmers/ institutions may write to the Geneticist, All India Coordinated Research Project on Goats, Mannuthy.

7. Cost involved in the adoption of the technology by each farmer:

Rs.417.60 for the purchase of buck. About Rs.600/- per annum for feeding and Rs.200/- for construction of a shed. About Rs.25/- for veterinary aid.

For individual farmer for mating the doe Rs.3/- service.

8. Remarks:

Training in goat rearing with special emphasis to buck rearing can be imparted by the Kerala Agricultural University.

Popularisation of A.I. in goats for multiplication is another possibility, about which more details are yet to be worked out.

Pulses and Groundnut in Rice fallows

1.	Title of Technology	: Pulses and groundnut in Rice fallows.
2.	Experimental evidence	: The trials and demonstrations conducted in Rice fallows under the Village adoption scheme and National Demonstration Project reveal that the cultivation of groundnut and pulses in rice fallows is economical and profitable both for the farmer and for increasing the fertility of the land.
3.	The improvement expected after following the technology by the Selected marginal farmers.	: The farmer can anticipate better economic returns from his limitted land through multiple cropping. An average profit of Rs.800/- and Rs.1500/- per hectare can be obtained by cultivating pulses and groundnut in Rice Fallows.
4.	The Procedure to be followed or the package of practices to be followed by the farmer.	: page 85 & 86 of annual Report.
5.	Infrastructure required by the farmer	:Irrigation once in 10 days in the case of Groundnut.
6.	Availability of inputs	:Groundnut seeds can be procured from the farmers who conducted the Demonstrations in Trichur District, through the National Demonstration Staff of Kerala Agricultural University. The seeds will be decorticated and supplied to the required cultivator at their cost. Seeds of pulses are available from the Rice Research Station, Pattambi.
7.	Cost involved in the adoption of the technology by each farmer.	: For pulses of Rs.800 per hectare. and for Ground Nut Rs.1600/- per hectare.
8.	Remarks.	: Rice fallow Cultivaion is a necessity for the marginal farmer for getting returns from his limitted land resources. Groud Nut as an oil crop has immence potentialities for starting Agro based Industries in Kerala

PACKAGE OF PRACTICES FOR GROWING GROUNDNUT IN RICE FALLOWS

Soil: Well drained, sandy soils having high water table will be useful for raising as an irrigated crop. In other soil types, irrigation will have to be provided as and when required. The field is ploughed three to four times. Two tons of well rotten cattle manure along with N.P.K. at the rate of 10: 50: 40 is applied and final ploughin and levelling are done. Furrows and beds are formed at 30cms and 1 metre apart, respectively.

Seeds:

Ground nut seeds, Pollachi-I, Pollachi-II, MV-2, MV-7 varities can be used for planting.

Seed rate :

80 to 100 kg of groundnut kernals are required for planting one hectare.

Spacing : 20 cms x 10 cms.

From plant to plant and row to row. The sowing may be done in such a manner that the entire beds should be covered with groundnut foliage within twenty days of planting of the seed. Otherwise weed grwoth will have to be controlled by hand weeding.

Irrigation :

Irrigation may be given as and when necessary.

Top dressing with lime :

The crop required ample amount of lime especially at the time of pod formation. Lime and ash at the rate of 500 kg each per hectare may be applied as top dressing within 25 to 30 days after sowing.

Harvest :

The crop under rice fallow conditions will be ready for harvest within 100 days. Harvesting may be done immediately. Otherwise the crop will be attacked by Tikka and leaves will be wilted or the pods will be eaten away by pod borers.

PACKAGE OF PRACTICES FOR PULSES IN RICE FALLOWS

In rice fallows, a tentative package of practices was drawn up in consulation with the officers of the Department of Agriculture, for implementation in farmers field. The package of practices drawn up and implemented and found to be well suited consists of the following items.

1. The field is ploughed twice when the field attains field capacity. Then lime is applied at the rate of 150 to 250kg.ha. depending upon the pH of the soil.

2. Urea, superphosphate and Muriate of potash are applied as basal at the rate of N:P:K. 10:30:10 kg. per hectare.

3. Cowpea seeds at the rate of 25 to 30 kg per hectare are broadcast over the ploughed field.

4. A wooden plank is drawn out to level the ploughed surface.

5. Irrigation channels are to be provided 2 metre apart, to serve as efficient water courses for irrigation.

6. Urea solution within 2.5 to 3% strength and Dimecron 250 ml. in 500 litres of water per hectare was sprayed twice during the growth period of the crop. First spray is given within 20 days after sowing and the second just before flowering (10 litre water + 250 gm. Urea + 5 ml. Dimecron). This method of application of Urea and insecticide was found to help in increasing the leaf area of the pulse crop quickly and thereby resulted in smothering the weeds. The systemic insecticide dimecron controls the sucking insects and to an extent solves the stray cattle problem. The cattle owners are relectuat to send out their cattle due to fear of food poisoning from the sprayed fields.

7. Choice of the varities :

In cowpea, different duration groups are now available (Table - I). According to the soil type and its moisture retension capacity the chocice of the best suited varieties can be made.

Companion cropping technique for growing Groundnut and Tapioca

Title of the technology: COMPANION CROPPING OF GROUNDNUT WITH TAPIOCA IN KERALA.

Tapioca is the second major annual crop cultivated in an area of 316,000 hectares in Kerala, both for food and for commercial purposes. It is planted either on individual mounds or on ridges. Usually it takes about two months for its establishment and development of a leaf canopy. The crop is harvested in about ten months time.

In order to take advantage of this situation, various multiple cropping patterns were tried at various Research Stations in the State. The Central Tuber Crop Research Institute, Sreekaryam, Trivandrum has recorded that among the intercrops tried in tapioca, groundnut fits well in the cropping pattern. This will increase the net profit for the farmer.

Investigations conducted at the Rice Research Station, Pattambi in 1975-76 has indicated that groundnut can be grown with tapioca as a companion crop where the groundnut was sown in two rows on each side of the ridges on which the tapioca was planted on the same day itself. In Indonesia, groundnut is intercropped in large scale for obtaining oil seeds as well as for the purpose of production of haulms(leaf and stem) as fodder for cattle.

Even though research data are available for the development of groundnut cultivation, these have not been effectively communicated to the farmers.

In order to fill up this extension gap, the Kerala Agricultural University took up a programme of trials and demonstrations on farmers' fields in Trichur district during 1976-78. This was on marginal and submarginal uplands under rainfed conditions during May-June.

In these demonstrations conducted under the National Demonstration Project, an average yield of 1263 kg. of dry groundnut pods and 2481 kg. of haulms (Fodder) could be obtained at an average cost of Rs.1,467/- per hectare within a period of hundred days. The gross income from groundnut pods and haulms was estimated at Rs.2,778/- per hectare. Since the groundnut is intercropped at the time of planting tapioca, the cost of seed and harvest charges alone are the main items of additional expenditure that the cultivator has to incur the cost benefit ratio being about 1:2. It is also observed that in comparison with the crop, the yield of tapioca has not decreased due to this companion cropping system. The average yield data recorded from the demonstration on companion cropping of groundnut with tapioca conducted during 1976 to 1978 are given in the table No.I.

These demonstrations have indicated the immense possibilities and potentialities for increasing the income of the farmer from the marginal and submarginal uplands under rainfed conditions. This companion cropping pattern has the following advantages.

1. The companion cropping programme suggested is only a simple adoption of a sowing practice by which the farmer needs only to dibble the groundnut seeds at the time of planting tapioca.

2. The crop is raised as a companion crop, no new land need be set apart for the crop.

3. In the monoculture of tapioca the time lag factor is as much as ten months. This new cropping pattern has the advantage of earlier returns.

4. The production of pulses in the State is being reduced year after year. By the adoption of the present technique of intercropping, at least one lakh hectares can be brought under groundnut in the near future. Thereby the present production can be augmented several times.

5. Pulses are cheap form of proteins. The availability of these protein rich food in the country side will go a long way in meeting the protein requirements.

6. The production of haulms during the lean period for green fodder (August-September) is a boon for the farmer.

7. This cropping system will create additional employment potential in the villages which is estimated to be 60 unskilled work days per hectare. It will be therefore be highly advantageous for the un-employed labourers of the villages. Even at a rough estimate one lakh hectare can immediately be utilised for the companion cropping programme, which will generate 60 lakh work days during the crop season.

8. Production of oil seeds within the State will lead to the establishment of oil based agro-industries in the State. At present for groundnut oil and cake we are completely dependent upon other States.

9. The development of oil based Agro-Industries in the State can also absorb large number of skilled labour.

10. The groundnut cake obtainable from this industry is a nutritive cattle food and also an organic manure which is in great demand in this State for the above purposes.

Due to this intercrop being latter the yield of tapioca as the base crop, is not affected. Being a leguminous crop the fertility status of the soil is also enhanced due to the cultivation of groundnut.

The Package of Practices for growing groundnut as companion crop with tapioca is given separately.

Groundnut seeds:

Groundnut seeds can be arranged from the local National Demonstration farmers at the rate of Rs.4/- per kg of pods. The pods will have to be decorticated before planting.

TABLE - I

DATA OBTAINED FROM THE CULTIVATION OF GROUNDNUT AS A COMPANION CROP WITH TAPIOCA UNDER THE NATIONAL DEMONSTRATION PROJECT, IN TRICHUR DISTRICT DURING 1977-78 - AVERAGE DATA OBTAINED FROM SEVEN DEMONSTRATIONS ARE GIVEN.

No. of locations	Average yield of dry groundnut pods.	Average yield of haulms.	Average additional income.	Average additional expenditure.	Profit from the intercrop of groundnut.	Average yield of tapioca as pure crop.	Average yield tapioca where it was intercropped.
	kg/ha	kg/ha	Rs./ha	Rs./ha	Rs./ha	ton/ha	ton/ha
7	1263 kg	2481	2,778/-	1467	1311	12.280	12.250

Cost benefit Ratio - 1:2

The demonstrations were conducted on submarginal lands. Hence the yield of tapioca tuber was comparatively low.

Tapioca variety-M4
Groundnut variety-TMV2

Costs:

Groundnut seeds	Rs.4/- kg
Groundnut pods	Rs.2/- kg
Tapioca tuber	Rs.0.25/kg
Men at Rs.8/- per day.	
Women at Rs.6/- per day.	

PACKAGE OF PRACTICES - GROUNDNUT AS A COMPANION CROP WITH TAPIOCA

Preparatory cultivation:

Prepare the land and form ridges or mounds depending upon the soil type and topography of the land in order to ensure good drainage. The ridges may be prepared at a distance of 1 metre apart and 0.75 metre from top to top in the case of mounds.

Sowing:

Tapioca sets may be planted 0.5 metre apart on the ridges on the top of the mounds. Groundnut seeds are dibbled on the same day on both sides of the ridges in two rows at a distance of 20 cm. between plants and 20 cms. between rows. 16 to 20 seeds are to be planted in case of mounds ie., 6 seeds at 20 cms. below the top of the mounds and 10 to 14 seeds at the lower circle. Sufficient space has to be left at the lower side of the mounds as well as at the top portion of the ridges and mounds. 65 to 75 kg of decorticated groundnut seeds are necessary to dibble one hectare.

Quality seeds should be used in order to ensure early establishment of groundnut.

Manures and fertilizers:

At the time of preparation of land organic manure at the rate of 5 tonnes and fertilizers at the rate of 34 kg each of NPK per hectare are added before the ridges or mounds are formed for tapioca.

Season:

May to June is the best time for planting tapioca and groundnut.

Varieties:

1. Tapioca : M4 is highly suited for this cropping pattern.

2. Groundnut: Erect varieties such as TMV2, TMV7, Pollachi-1 and Pollachi-2 are suited for dibbling.

1st top dressing:

At the time of flowering groundnut ie., 30 days after sowing apply 500 kg each of fresh lime, and ash per hectare and earth up. Weeding may also be done, if necessary. Do not disturb the soil 45 days after sowing.

2nd top dressing (For tapioca alone):

After the harvest of groundnut, tapioca may be earthed up incorporating N.P. and K. at the rate of 17 kg. each per hectare.

Pest and disease of groundnut:

Pest control: Incidence of leaf caterpillar may occur. The pests can be controlled by dusting Lindane.

Rates and rodents: For the control of Rodents, bait with zinc phosphide or any other rodenticide. When it is mixed with fresh coconut kernal peelings, zinc phosphide is an excellent rat killer.

Disease control: Tikka leaf spot may appear at the late maturity period of nut. Usually, no control measures are taken as this disease generally is noted towards the time of maturity.

Harvest:

Groundnut can be harvested when the crown foliage turns yellow. The crop should be harvested within a period of 100 days from sowing. Otherwise the crop will be affected by Tikka disease or the pods attacked by Pod borers.

Immediately after the harvest the nuts should be dried in the sun for five to six days.

Haulms:

The bhusa is a nutritive fodder for cattle.

Yield:

An average yield of 1250 kg of groundnut pods as well as 2000 kg of fodder can be obtained from the intercrop. The yield and quality of tapioca has not been found to deteriorate due to this intercropping pattern.

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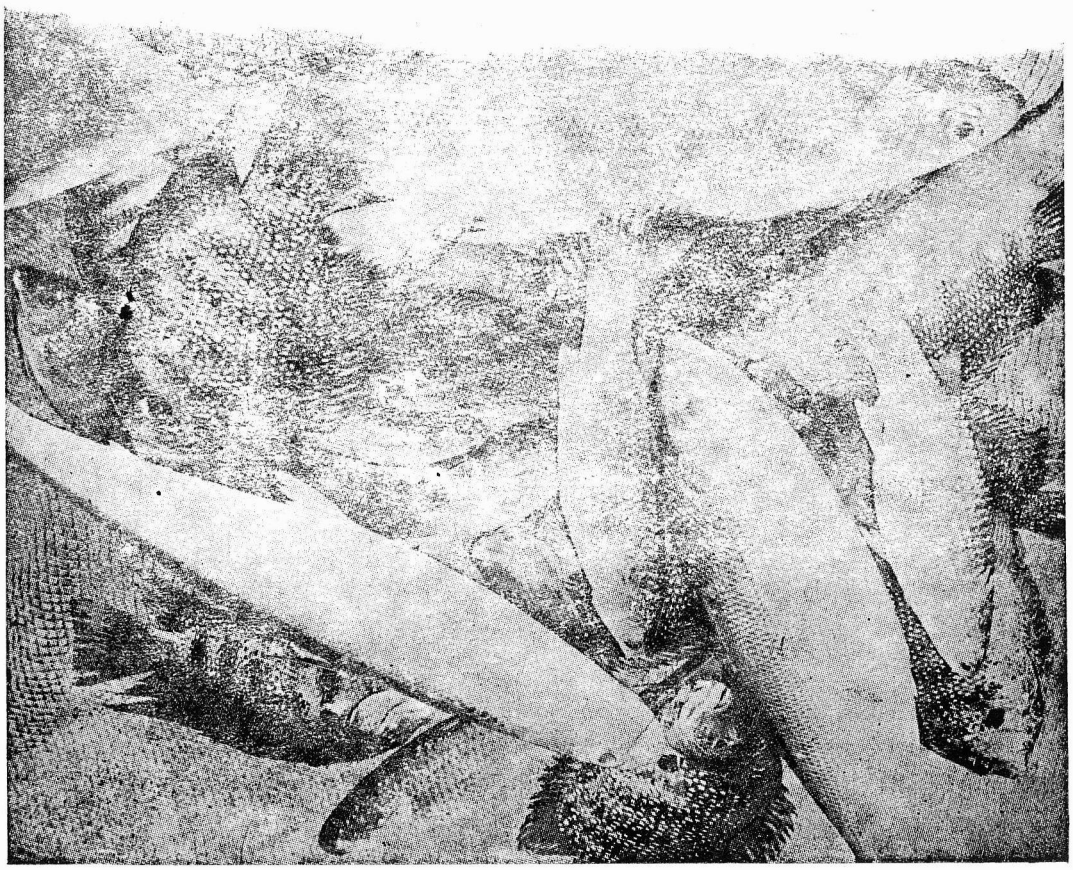


Recycling of plant and animal waste for establishment of the inland fishery

1. Title of technology : Recycling of animal and plant wastes through inland fish farming.

2. Experimental Evidence : The Principle of quick organic recycling to maximise production has been put to practice through the integrated farming of crops, livestock and fish. It has been found from experiments conducted at Mannuthy using poultry manure in fish ponds and at Kumarakom using dairy farm wastes, cowdung, wash water etc. that the production of fish could be increased considerably by judicious use of farm yard wastes and waste water. Cowdung has been found to produce zooplankton blooms as against phytoplankton blooms caused by the use of inorganic fertilizers. In general organic manures are superior to inorganic fertilizers in fish farming and are easily available in the Farm itself. Inorganic fertilizers can be used, however to correct the deficiencies in the pond soil and water. As such, in homestead farms, the agricultural wastes, cowdung, urine, wash water, poultry and piggery wastes, etc. could be profitably used in the fish ponds for increasing fish production. However, organic manures should not be used too much so as to pollute the waters and create oxygen deficiency in the water.

3. The improvement expected after following the technology by the selected marginal farmers: The farmers can anticipate better economic returns from his limited land through mixed farming of Crops, Livestock and fish. Fish Farming need not be looked upon as competitive with general agriculture, but can be practised as a complementary activity. It will be realised that apart from the usefulness of a fish pond in water conservation and storage, farm yard wastes could be profitably used for increasing fish production.

4. The procedure to be followed or the package of practices to be followed by the farmer: The bunds of the ponds should be strengthened so as to retain atleast 1.5 meters of water. The weeds and unwanted and predatory species of fish should be eradicated. In case of big ponds, which cannot be easily drained and dried, poisoning with Mohua oil cakes, (@ 150 to 250 ppm is recommended. Fingerlings can be stocked only after about 15 days, after conducting detoxification tests.

It is advisable to have the Dairy Farm or cattle shed near the fish pond at an elevated place. The wash water

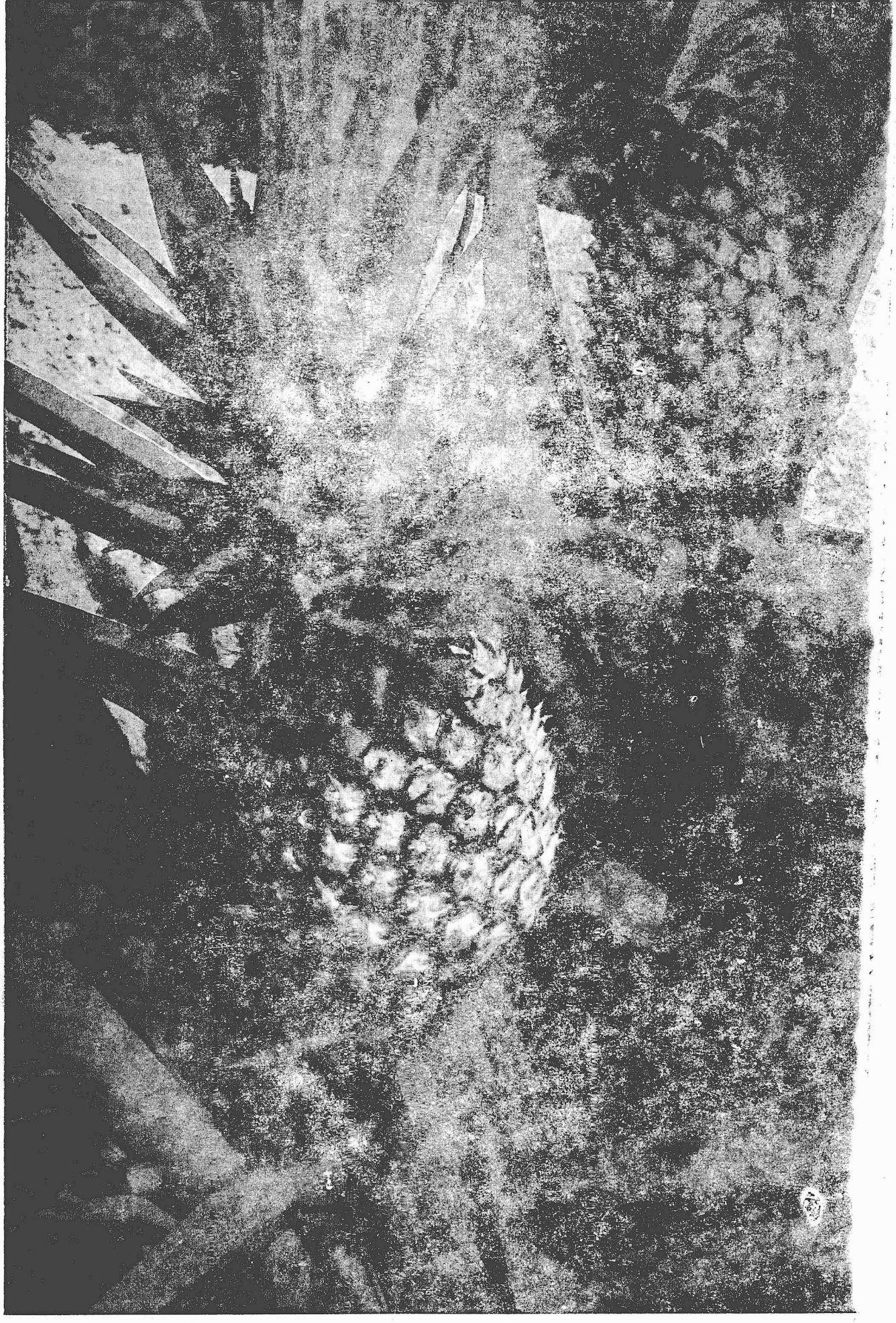
and urine could be collected in a small cement cistern by gravitational flow and then lead from there by pipes or channels into the different fish ponds. It is estimated that the yield of dung per cow per annum would be around 7.3 tonnes, of fodder waste 1.5 tonnes and urine 4.4 kilo litres. The dung, urine and fodder waste resulting from keeping a single cow can be used in fish ponds extending to about one hectare, provided the average depth of water is more than 1.5 m. If the water is shallow lesser doses should only be used to avoid depletion of dissolved oxygen. Only when new ponds and nursery ponds are prepared the cow dung could be broadcasted in diluted form. In stocking ponds, the cow dung should be put in small heaps only to enable gradual leaching of thenutrients.

Treatment of water may be required for correcting acute deficiencies. First of all, lime is applied to correct PH if required. Organic manures are then applied and inorganic fertilizers like super-phosphate is applied later, if required. Inorganic nitrogenous fertilizers need not be applied. Compost of aquatic weeds can be applied.

The well-formed outer bunds of the ponds could be planted with coconut seedlings. The narrow inner bunds could be used to raise horticultural plants according to the type of soil of the area.

The fish ponds stocked with fingerlings of species like Catla, Rohu, Mrigala, Common carp, the Chinese carps, Pearl spot etc. could be harvested any time after about 9 to 10 months, if breeders are not required.

5. Infrastructure required by the Farmer:: Fish ponds.
6. Availability of inputs: : A regular source for the supply of the required quantity of seed is to be ensured. Usually the Fish Farms run by the State Fisheries Department will be able to supply the seed of Indian Major Carps and the common carp. The seed of Pearlspot is available for purchase from the Fish Farm, Vyttila of the Kerala Agricultural University.
7. Cost involved in the adoption of the Technology by each Farmer: : Cost of consgtruction of farms is highly variable according to the type of soil and location of the ponds. Existing ponds are to be utilised, as far as possible.
8. Remarks: : More research is under way on the different aspects of the technology to suit the different situations.



High density Pineapple Planting

1. Title of Technology: High Density Pineapple Planting.

2. Experimental evidence:

Experiment to assess the growth and yield of Pineapple variety 'Kew' as influenced by 21 planting densities were conducted at the Pineapple Research Centre, Kerala Agricultural University, Vellanikkara during the years 1974-76. The design of the experiment was split plot with seven replications. The observations recorded on growth characters of plants revealed that population densities did not influence leaf production, leaf area index and duration of plant crop. Production of suckers per plant was seen influenced by spacings.

Data on productivity showed that the average fruit weight with crown was not affected by the population densities whereas it influenced fruit weight devoid of crown. The cost benefit analysis though indicated the advantage of adopting spacing of 75 cm. between trenches, from the practical point of view of easy agronomic practices especially in ratoon crop season, a population density of 53,333 suckers/ha allowing interspaces of 90 cm between trenches, 60 cm between rows and 25 cm between plants was best.

Table 2. Yield characteristics on different planting densities

Treatments.	Average fruit weight with crown (kg)	Average fruit weight without crown (kg)	Average weight of crowns (kg)	Yield of fruits/ hectare with crown (tons)	Yield of fruits per hectare without crowns (tons)
1	2	3	4	5	6
T_1S_1	1.53	1.112	0.230	69.24	50.48
T_1S_2	1.64	1.346	0.170	80.83	71.76
T_1S_3	1.37	1.171	0.190	87.05	74.35
T_1S_4	1.55	1.374	0.170	91.63	81.46

1	2	3	4	5	6
E_1S_5	1.65	1.233	0.195	102.04	76.02
E_1S_6	1.42	1.231	0.180	108.10	93.81
E_1S_7	1.38	1.029	0.372	148.15	110.16
E_2S_1	1.36	1.164	0.195	73.13	59.69
E_2S_2	1.19	0.995	0.190	67.72	56.86
E_2S_3	1.33	1.146	0.185	88.73	76.40
E_2S_4	1.29	1.213	0.170	76.37	73.88
E_2S_5	1.44	1.288	0.180	104.97	92.05
E_2S_6	1.43	1.275	0.150	114.22	102.01
E_2S_7	1.41	1.039	0.367	150.70	111.32
E_3S_1	1.34	1.149	0.192	72.77	60.06
E_3S_2	1.57	1.393	0.180	90.08	79.78
E_3S_3	1.34	1.139	0.195	91.58	76.05
E_3S_4	1.52	1.259	0.180	95.63	79.80
E_3S_5	1.35	1.149	0.180	101.05	87.52
E_3S_6	1.41	1.253	0.150	115.36	102.83
E_3S_7	1.37	0.943	0.450	150.52	104.76
CD 5% for rows	NS	NS	NS	NS	NS
CD 5% for spacking	NS	0.098	0.008	9.40	10.145

Table 3: Cost benefit analysis of certain promising population densities

Details	43,582 (Base) (P_1S_1)	Population densities per hectare 53,333 (P_1S_2)	63,492 (P_1S_3)	59,259 (P_1S_4)	51,666 (P_1S_5)	76,190 (P_1S_6)	1,07,030 (P_1S_7)
1. Addl.cost in rupees incurred for:							
a) Suckers ..		1749.22	3984.20	3052.94	3582.48	6777.76	13562.56
b) Fertilizers ..		565.32	1287.62	986.65	1157.79	2190.45	4383.17
c) Growth regulator application ..		247.28	563.22	431.57	506.43	968.13	1917.25
Total additional cost ..		2561.82	5833.04	4471.16	5246.70	9926.34	19862.98
2. Yield of fruits with crown in tons/ha. obtained	69.24	80.83	87.05	91.63	102.04	108.10	148.15
3. Extra yield obtained in tons/ha. ..		11.59	17.81	22.39	32.80	38.86	78.91
4. Cost in Rs. of extra yield @ Rs.600/- per ton ..		6954.00	10686.00	13434.00	19680.00	23316.00	47346.00
5. Cost benefit ratio(ratio of 1:4) ..		1:2.71	1:1.83	1:3	1:3.75	1:2.35	1:2.39
6. Yield of fruits without crowns in tons/ha obtained	50.48	71.76	74.35	81.46	76.02	93.81	110.16
7. Extra yield obtained in tons/ha ..		21.28	23.87	30.98	25.54	43.33	59.68
8. Cost in Rs. of extra yield @ Rs.600/tons ..		12768.00	14322.00	18588.00	15324.00	25998.00	35808.00
9. Cost benefit ratio (Ratio of 1:8) ..		1:4.2	1:2.4	1:4.2	1:2.9	1:2.6	1:1.8

3. The improvement expected after following the technology by the selected marginal farmer:

High population densities are found to be responsible for securing higher tonnage of fruits per ha. On a practical consideration, the increased tonnage can be beneficial if only it is advantageous on a cost benefit ratio analysis and easy crop management in ratoon crops. By adopting the suggested high density planning, the cultivator can get higher yield, consequently higher income.

4. Procedure to be followed:

The present system in vogue in cultivators' fields in planting pineapple is planting a population density of about 15,000 suckers/ha adopting spacings of 45 cm. between plants, 60 cm. between rows and 90 cm between trenches in double row system of planting. This method yields about 25-30 tonnes of fruits/ha in the third year after planting as the flowering under natural conditions in plant crop season is only 30-40 per cent. The trend of production of fruits under natural condition if considered, it can be found that maximum production of crop is in the month of July when rains are at its full swing consequent of which the cultivators do not get good price. Further, manual weeding of planted plots involve a sizeable expenditure. To place the crop production on economical fooling, it is necessary to enhance the yield besides ensuring early returns. To accomplish the above objectives, the following package of practices is recommended.

Preparation of land:

Prepare land for planting by ploughing or digging followed by levelling. Prepare trenches of convenient length of 90 cm width and 15-30 cm depth. Provide proper drainage.

Planting materials:

Select healthy suckers of uniform size for planting. Strip of a few lower old dried leaves.

Planting:

Dip the cured suckers in 1% boardeaux mixture at the time of planting. The soil of the field beds and plant suckers in double rows at a spacing of 60 cm between rows and 25 cm between planting limiting the depth of planting to 7.5 - 10 cm (Plant population 53,333 suckers/ha) Adopt triangular method of planting so that plants in two adjacent rows are not opposite to each other.

Manures and fertilizers:

Apply compost/FYM at 25 tonns/ha. As basal dressing apply fertilizers at the following dosages.

Nutrients	Per Plant in g.	Per ha. in kg.
N	8	400
P_2O_5	4	200
K_2O	12	600

Apply P_2O_5 in full dose at the time of planting. N and K_2O may be applied in 2 splits in May-June (at planting) and October-November. After application of fertilizers, earth up the plants.

After cultivation:

1. Weed control:

For effective and economic weed control, use weedicides. Pre-emergence spray with diuron at 3 kg/ha (in 600 litres of water), Controls most of the weeds. If there is subsequent growth of weeds, repeat herbicide application at half the above dose. Spraying may be done when there is moisture in soil. Avoid period of heavy rainfall.

2. Induction of flowering:

For inducing early and uniform flowering, apply growth regulator when the plants are 14½-16 months old(39-42 leaf stage). A combination treatment of 25 ppm Ethrel + 2% urea + 0.04% calciu/sodium carbonate is suggested for the same. 50 ml. of the above solution should be poured into the heart of each plant during dry weather. Flowering will commence from 40th day after application and will be completed by 70 day. For applying in 1000 plants, the following quantity of different chemicals will be required:

Ethrel - 2.6 ml. Urea - one kg.
Calcium/sodium carbonate - 20 gms
water - 50 litres.

Propagation for fruits

Wrap the fruits with leaves of plants to prevent sum scorch and damage.

5. Infrastructure required by the farmers:

Land	:	0.15 hectares.
Planting materials (suckers)	:	8100 Nos.
Herbicide diuron	:	0.75 kg.
Growth regulator-application	:	Ethrel - 22 ml. Urea - 8.1 kg Calcium carbonate - 165 g.

6. Availability of inputs: All inputs are readily available in market.

7. Cost involved in the adoption of technology by each farmer:

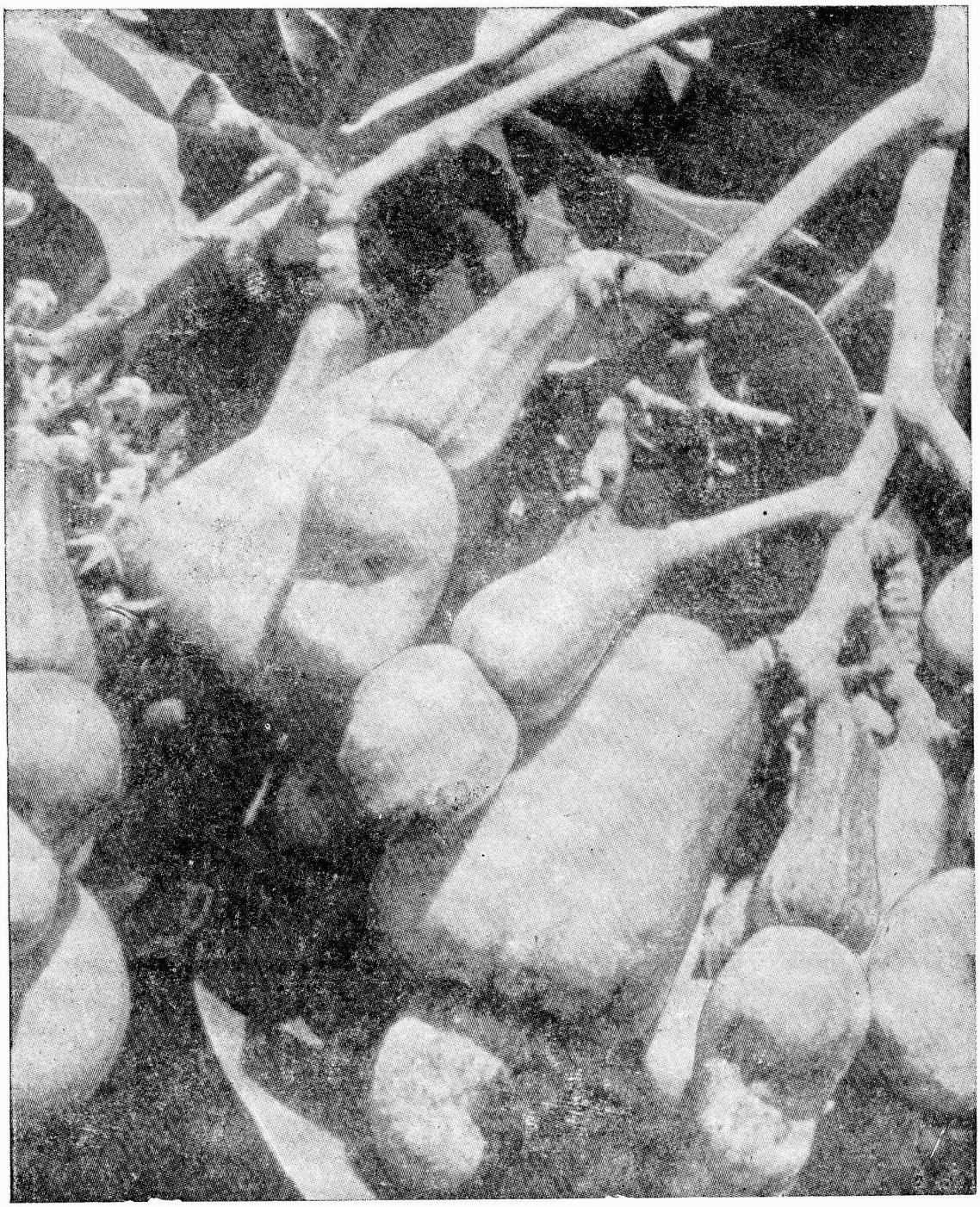
Cost of 8100 suckers @ Rs.20 per 100 Nos.:	Rs.1,620.00
Cost of 0.75 kg diuron @ Rs.110 kg including cost of application twice ie., Rs.1600 per hectare.	240.00
Growth regulator application @ 1.2 paise/plant including cost of chemicals and charge of application	97.20
Total	Rs.1,957.20

Rounded to Rs.2,000/- as a safeguard against fluctuations in prices of commodities.

8. Remarks:

Eventhough the total expenditure has been shown as Rs.2,000 per plot, the cultivator has to spend actually the cost of extra inputs only compared to method of cultivation in vogue ie., as against the adoption of population density of 15,000 suckers/ha.

The method suggested will ensure 98% of harvest within 2 years of planting recording atleast an yield of 50 tons/ha in plant crop season. The yield per plot will be about 7.50 tonnes costing Rs.4500 @ Rs.600 per ton of fruits as against the expenditure of Rs.2,000/- per plot.



Preservation of Casew Apple Juse

1. Title of the technology: Preparation of processed products from cashew apple and other fruit residues.

2. Experimental evidence:

The cashew apple contains a juice which is rich in sugar, vitamin C and minerals. The cashew apple production is estimated to be over 6 lakhs tonnes in our State. This is practically wasted at present. A substantial quantity of this can be made use of as soft drinks or fermented products, if the farmers are trained in the processing and preservation of cashew apple. The reason for non-utilisation of the cashew apple is due to an astringent taste due to the presence of tannins and some other acrid principles. Studies at the CFTRI have revealed that these astringent principles can be removed either by treating with 0.25 to 0.4% gelatin or by subjecting the fruits to steam at 5-15 lbs pressure for 5-15 minutes. The clarified juice may be bottled after adding sugar to bring the brix to 15° and acidity 0.4% by adding citric acid. Boil the juice for a minute and fill hot until over-flows and pasturise at 85-90° for 30 minutes. Recipes for other products like juice concentrates, candy, jam, pickle, fermented liquors etc. have also been standardised. The clarified juice can also be blended with other fruit juices like pineapple, lime and mango to improve the flavour.

Jack is another fruit of Kerala, which is not fully utilised. Recent studies in the College of Horticulture have shown that jams can be made from the flakes and jelly from the aborted flakes and rind.

3. Improvements expected:

The utilisation of the above waste products is expected to bring in additional income to the farmers.

4. Procedure to be followed:

The setting up of a processing unit on a cottage scale is expected to cost about Rs.5,000/- for purchasing the equipments needed. The essential items of equipments and their approximate cost are given below:

		Approx.cost
Can sealing machine	(1)	Rs.500.00
Hand can sealer	(1)	650.00
Hand refractometer	(1)	500.00
		1650.00

B/F		Rs.1650.00
Cone type Hand wheel juice extractor - 1		450.00
Two Pan 10 kg balance with weights (1 gm to 10 kg) (one set)		300.00
Thermometer 0-250°C	(1)	25.00
Stainless steel wares - various sizes		2000.00
Basket Press	(1)	650.00
Rounded to Rs.5,100/-		5075.00

6. Availability of the inputs:

Apart from the cashew apple and jack fruit, other fruits grown in our State can also be utilised during the periods when the above mentioned fruits are not available.

7. Cost involved:

The capital cost for establishing a small unit is estimated at Rs.5,000/- excluding the working expenses.

1. Title of the technology: Ameleoration of problem soils (acid sulphate soils)

2. Experimental evidence:

Application of the following ameleorants have been observed to improve the soil and increase production of rice.

i) Chakaric hor at 500 kg/ha.
ii) Arecanut pealings @ 500 kg/ha.
iii) Soft carbon dust @ 1000 kg/ha.

3. Improvement expected after following the technology by selected marginal farmer:

The improvement expected are:

i) An yield increase of 540 kg/ha from Chakaric hor.
ii) An yield increase of 500 kg/ha from Arecanut pealings.
iii) An yield increase of 325 kg/ha from carbon-dust.

4. Procedure to be followed:

i) Chakaric hor at 500 kg/ha as top dressing at tillering.
ii) Arecanut peelings at 500 kg/ha as basal dressing.
iii) Carbon dust as top dressing at tillering at 1000 kg/ha.

5. Infrastructure required: NIL

6. Availability of inputs: Locally available.

7. Cost involved: Chakaric hor Rs.40/- per quintal
Arecanut peel Rs.40/- "
Carbon dust Rs.100/- "

8. Remarks: --

Intercropping of Cocoa jn Coconut Gardens

1. Title of technology: Intercropping of cocoa in coconut gardens.

2. Experimental evidence:

Attempts to identify crops suitable for intercropping in coconut gardens have been made by organisations like the Kerala Agricultural University, CPCRI, etc. Among the perennial intercrops suitable for coconut gardens, cocoa has been found to be one of the most promising. An experiment started in 1970 at the Coconut Research Station, Pilicode examined the effects of raising cocoa as an intercrop on the yield and bearing habit of coconut apart from studying the performance of cocoa itself in different systems of planting. The results indicated that double row planting gave maximum number of pods two years after planting than single row planting. With regard to the effect of cocoa on the yield of coconut, there was no reduction in the yield of coconut even after four years of planting cocoas. Studies at the C.P.C.R.I. also proved that cocoa performed well in the interspaces of coconut. Forastero plants made excellent growth and flowered within ten months of planting.

Realising the importance of cocoa and its suitability as an intercrop in coconut gardens, farmers have taken up cocoa cultivation in a big way. Passing on correct and scientific information about the various phases of cocoa cultivation will be of immense value and most appropriate.

3. The improvement expected after following the technology by the selected marginal farmer:

The farmer can definitely expect to get increase in the net income from his/her holding. This will be a result of the direct contribution of cocoa and also as a result of its favourable influence on the coconut palm.

4. The Procedure to be followed or the Package of Practices to be followed by the farmer:

Cocoa can be interplanted in coconut gardens upto 900 above MSL, provided the soil is clay loam, loam or sandy loam. The soil should be at least 1.5m deep. In the absence of facilities for irrigation, at least 100-150 cm. of rain fall is required per annum.

Four to six month old seedlings of Forestero variety are to be planted during May-June period. Additional temporary shade may be provided during the early phase.

100 g.N, 40 g. P_2O_5 and 140 g. K_2O per plant per year is the fertiliser recommendation. This should be split equally in April-May and September-October.

Staking and supporting the plants may be necessary during the early stages.

Till the plants form proper canopies, the field may have to be kept free of weeds. Later, this may not be required.

The plants may be trained to a single stem (Chupon) upto a height of 1.5 m to form a jourquette and three to four fan branches. Pruning may be done to achieve these objectives.

Careful harvesting (without causing injury to the cushion) of 170-180 day old fruits is to be done. At this stage the pods change colour.

Tray method is recommended for ferminting the beans.

5. Infrastructure required by the farmer:

None at present.

If the present system of buying fresh cocoa (beans) is stopped by the companies, fermentation units may have to be set up on cooperative basis.

6. Availability of inputs:

The seedlings are available from various sources like, the Department of Agriculture, Kerala Agricultural University, etc.

Fertilisers required are also available freely.

7. Cost involved in the adoption of the Technology by each farmer:

On the average, the cost can be worked out as Rs.5.50 to 6.00 per plant per year.

8. Remarks:

Specialised training may be given to the farmers in the correct techniques of pruning, Tray method of fermentation of cocoa beans and judging the quality of fermented, dried bean.

New cropping system based on Relay cropping for drought prone areas

1. Title of Technology : NEW CROPPING SYSTEMS BASED ON RELAY CROPPING FOR DROUGHT PRONE AREAS.

2. Experimental Evidence : Poor establishment of the crop sown during the second crop season in the drought prone areas has been observed to be the limitting factor for production of crops.

The experiments conducted at Eruthempathy for two years from 1977 on wards have shown that the establishment of cotton grown during 2nd crop season as a relay crop in groundnut field is better than the pure crop grown after groundnut.

The cultivation of hybrid cotton Varalakshmy, 15 days before the harvest of groundnut in August as a relay crop or planted Tapioca in groundnut one month after the sowing of groundnut has been found to have early establishment and reasonable returns even under adverse weather conditions.

3. The improvement expected after following the technology by the selected marginal farmers. : In the Kozhinjapara farka, there are about 5000 heactore of droughtprone lands where this relay cropping technology will give assured return for the marginal farmer.

4. The procedure to be followed or the package of practices to be followed by the farmer Relay. : Varalakshmy hybrid cotton seeds are to be dittled one metre from row to row and 0.5m., plant to plant in the standing groundnut fields, fifteen days before the harvest of the groundnut. The seeds are to be sown by hand.

A. Cotton.

At the time of harvest of the groundnut, the cotton will be about four to five leaf stage. After the harvest of the groundnut, 34kg each of the NPK nutrients are supplied broadcast and the fields dug up by spade.

Further, the crop will be fertilised and plant protection measures taken as usual.

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B. Relay Tapioca.

The tapioca sets are just pushed into the field at a row to row distance of one metre, and plant to plant distance of 0.5metre, one month after the sowing of groundnut (in May). Due to the dry weather condition prevailing in the area during May and June, the growth of tapioca will be very much curtailed, but by this time the tapioca plant will have a good established root system.

Further cultivation method are followed as per the packages of practices. After the harvest of the groundnut 34kg NPK is broadcast and the crop is earthed up to form ridges as usual for the tapioca crop.

5. Infrastructurre required by the farmer : Hybrid cotton seeds
: A. Varalakshmy-Available from the super market, Coimbatore.
B. M4, Tapioca.
It is available from the Instructional Farm, Mannuthy, Kerala Agricultural University, Vellanikkara.

6. Availability of Inputs : NPK fertilizers are available locally.

7. Cost involved in the adoption of the Technology by each farmers : No extra cost will be incurred in the adoption of the relay cropping technique.

8. Remarks: :1. TheYield will be obtained 15 to 30 days before the main season,
2. The crop will be established early utilising the available soil moisture present in the field.

1. Title of Technology: Intercropping Guinea grass in coconut gardens.

2. Experimental evidence:

Experiments conducted at C.P.C.R.I., Kasaragod and Kayamkulam have revealed that intercropping fodder grass varieties in coconut gardens could be successfully done. In addition to the green matter yield obtained, an increase in the returns from the coconut trees also is reported. It is also observed that the intensity of the root-wilt disease of the coconut trees has been considerably reduced by this intercropping.

3. The improvement expected after following the technology by the selected marginal farmer:

The net income of the farmer can be expected to increase definitely. As animal rearing forms an integral part of agriculture, the productivity of the animals in terms of milk or work efficiency will be increased by feeding of fresh valuable fodder.

4. Procedure to be followed or the Package of practices to be followed by the farmer:

Almost all types of soils except waterlogged areas are suitable for cultivation. In thrives well in warm moist climate. Guinea grass can be planted in all the available land area after setting apart a 4 m. diameter basin for each of the coconut tree. Depending upon the number of trees the area available for guinea grass cultivation in one hectare of coconut garden will be 6850-7500 sq.metres.

Best planting season is the month of February, provided irrigation facilities are available. If not, May-June month is suitable, preferably on a drizly day.

Land is prepared by ploughing 2-3 times and making trenches of 20 cm depth and width. Apply 10 tonnes of farm yard manure and 50 kg P_2O_5 and 50 kg K_2O/ha. in trenches. Mix well, cover the trenches and make ridges of 15 cm height for planting slips. Acid soils may require 500 kg lime every alternate year. Spacing at 40 cm between rows and 20 cm between plants may be given, and plant rooted slips . Top dressing of 200 kg N/ha in two split doses, one after first cutting and second during Northwest monsoon may be done. First harvesting can be done 8 to 10 weeks after planting. Subsequent cuttings at intervals of of 30-35 days.

5. Infrastructure required by the farmer. None at present except the coconut gardens.

6. Availability of inputs:

A very promising variety of guinea grass is available at the Fodder Research & Development Centre of the Kerala Agricultural University at Mannuthy and the slips are available for sale.

Fertilizers required are available in the market.

7. Cost involved in the adoption of the technology by each farmer:

An amount of Rs.5,500/- will be required per every hectare of coconut garden, of which about Rs.3,250/- is labour charges. In a small area the farmer himself can attend to these works so that the cost will be negligible.

8. Remarks:

Intercropping of cowpea in guinea grass plots can be done, wherein a spacing of 60 cm: 30 cm may be given.

1. Title of Technology: Intercropping Cowpea in coconut gardens.

2. Experimental evidence:

Not much studies in the line are conducted. But intercropping Stylosanthes, another legume is successfully practised.

3. The improvement expected after following the technology by the selected marginal farmer:

Karnataka local cowpea is found to yield about 20 tonnes of leguminous greens per hectare which can replace at least 2.5 tonnes of concentrates fed to animals. Cowpea cultivation is worth adoption because of the leguminous organic residues available for fertility enrichment. If fed to livestock, the health and productivity of the animals improve which in turn improves the net income of the farmer.

4. Procedure or package of practices to be followed by the farmer:

Sandy loamy soils are most suitable. Coconut garden may be ploughed 2 times and shallow furrows opened at 3 metres apart for irrigation.

Basal dressing with 40:30:30 kg NPK/ha may be done. Seeds at 40-50 kg per hectare may be sown. If possible, shallow irrigation at 3-4 cm depth once in 15 days may be done.

10 kg/ha of N and K may be applied after every cut followed by an irrigation. First cutting can be done 45 days after sowing and subsequent two cutting at 5 weeks' intervals.

5. Infrastructure required by the farmer:

None at present except coconut garden.

6. Availability of inputs:

Seeds of Karnataka local variety of cowpea is available with Fodder Research & Development Centre and Instructional Farm of Kerala Agricultural University at Mannuthy and with the KLD & MM Board. If bulk quantities of seeds are required, Karnataka State Agro Seeds Corporation may be approached.

7. Cost involved in the adoption of technology by each farmer:

An approximate amount of Rs.1,500/- will be required for every hectare of coconut garden of which Rs.900/- will be towards labour charges, which a farmer can attend to by himself.

8. Remarks: Cowpea can be planted as intercrop among guinea grass in coconut gardens.

1. Title of Technology: Intercropping Kooba abool (Lucaena) in coconut garden.

2. Experimental Evidence:

Not much studies in this has been done in Kerala. A study is in progress at the College of Agriculture, Vellayani which shows that this can be practised with success.

3. Improvement expected after following the technology by selected marginal farmer:

Lucaena is a very promising variety of fodder tree providing protein rich foliage for feed to livestock and enriching soil by fixation of enormous amount of atmospheric nitrogen. The net income of the farmer is expected to have a direct increase by fodder production and an indirect increase by improvement of the productivity of the animals on one part and the fertility of the soil on the other.

4. Procedure or the Package of Practices to be followed by the farmer:

Lucaena leucociphala is a plant which grows well in any soil even under limited moisture regime by virtue of its deep and intensive root system. Direct seeding **or planting** 2 months old seedlings from the nursery may be done. Treatment of seeds for 5 minutes in concentrated sulphuric acid is reported to increase the germination rate.

Pits, 50 cm x 50 cm x 50 cm may be taken 2 m.wide apart in the coconut garden with 2 metre space between the **plants.** 10 tonnes of farm yard manure/ha may be applied and the pits covered. Seedlings can be planted during May-June months. First cutting can be taken 4 to 5 months after planting, at a convenient height so as to keep the plant as a bush. Subsequent cuttings can be had at 45 days interval. The tree is perennial and will stand for years.

5. Infrastructure required by the farmer:

None except coconut garden.

6. Availability of inputs:

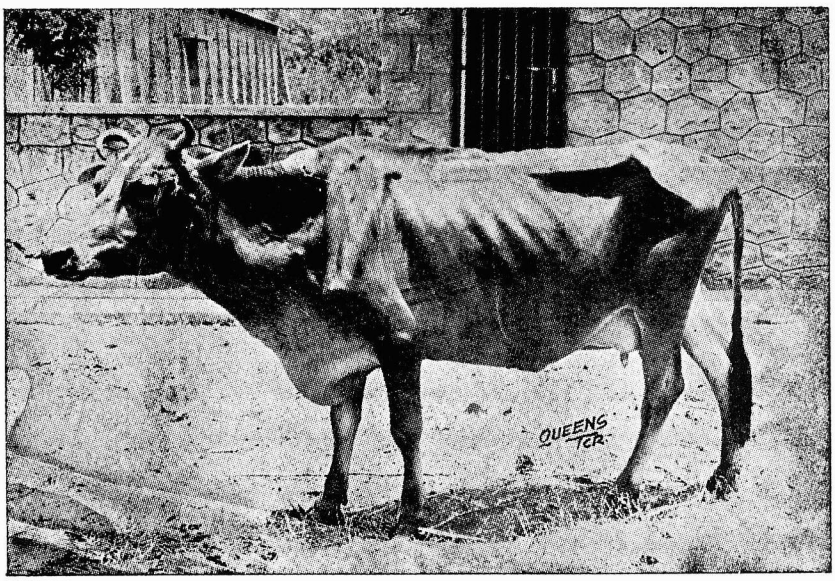
Seeds are available with the Fodder Research and Development Centre of the Kerala Agricultural University at Mannuthy.

7. Cost involved in the adoption of the technology by each farmer:

An amount of Rs.2,500/- will be required per every hectare of coconut garden. Of this, about Rs.1,200/- will be labour charges, which can be met by self-employment of the farmer.

8. Remarks:

Intercropping Lucaena with fodder grass varieties or cowpea or both can also be practised so as to enable maximum land utilisation and vertical harvesting of the resources of nature by multi-storied cropping techniques.



Parasites in cross bread Cow

1. Title of Technology: Control of worm parasites in cross-bred calves by periodic deworming.

2. Experimental evidence:

From the data collected by the department of Veterinary Parasitology of Kerala Agricultural University, it is evident that parasitic infection is very common among crossbred calves in Kerala. Observations made at the clinical laboratory at Veterinary hospital, Trichur for the past 10 years indicate that the large round worm, Ascaris vitullorum, is found in calves only upto 3 months of age. The blood sucking strongyle worms are seen in calves from 2 months to 2 years of age. Thereafter calves normally become immune to worm infections. Tape worms do not produce a serious disease, but their presence is also very common in calves. The large round worm Ascaris is transmitted to calves only through the mother during pregnancy, while the other worm infections are acquired from outside.

The comparative efficacy of various anthelmintics have been studied in detail in the department of Veterinary Parasitology of the Kerala Agricultural University (Kerala J.Vet.Sci. 1 (2), 2 (2), 3 (1), 3 (2), 4 (1) & 5 (1)). With this knowledge in hand, most successful deworming measures can be adopted in crossbred calves.

3. Improvement expected:

By careful adoption of parasite control measures, the calf mortality and delayed puberty problems can be overcome successfully. Healthy crossbred calves kept parasite free and in good plane of nutrition will react puberty at least by 1½ years of age.

4. Procedure to be followed:

1) On 21st day after birth give piperazine adipate at the rate of 250 mg/kg body weight.

2) Repeat the treatment after 3 weeks.

3) On the second month give the first dose of medicines for strongyles. For this 'Helatae' 30 g/40 kg wt., or phenovis 200 mg/kg can be used. Avoid phenovis in the case of weak calves.

4) Repeat the above treatment once in a month for 6 months and then once in 2 months upto about 1½ years.

5. Infrastructure required by the farmer:

NIL

6. Availability of inputs:

Piperazine compounds are available in the market under different names ie., Verban, Vermex, Helmacid, Antepar, Piperex and Piperazine adepate powder. Drugs against strongyle worms mentioned above are also freely available.

7. Cost involved:

Total cost of the complete course of deworming will come to a maximum of Rs.25.00.

8. Remarks:

It is better to get the animals examined in a Veterinary Clinic before deworming. Reinfection of worms can be prevented by proper manure disposal and other hygenic measures.

Feed restriction Poultry

1. Title of technology: Feed restriction in replacement pullets.

2. Experimental Evidence:

Feed accounts for over 70% of the cost of production of eggs. Limiting the feed intake, especially of layer replacement pullets would help reduce the total cost of production of eggs. Raising of replacement pullets is financially critical period in the sence that the farmers get no returns. The idea of reducing the feed intake during growing period is not novel. Extensive studies have been reported from foreign countries. In India Detailed studies have been carried out at the Kerala Agricultural University. The work conducted at the Department of Poultry Science, Kerala Agricultural University have clearly shown that restricting the feed intake of replacement pullets to 70-80% of full feeding (20-30% restriction) from 8 to 20 weeks of age or with drawing the feed on any one day in a week is economical and these programmes do not have any deterimental effect either on egg production or egg quality traits.

3. The improvement expected after following the technology by the selected marginal farmer:

The poultry farmer will be able to save substantially in the over-all feed cost thereby the cost of producing the egg will also be reduced.

4. The Procedure to be followed or Package of Practices to be followed by the farmer:

Replacement pullets need be given only 70-80% of feed that they normally consume. This restriction is to be effected only from 8 to 20 weeks of age. Once the birds come to production restriction of feed should be stopped and they should be given all the feed that they could eat.

5. Infrastructure required: None.

6. Availability of inputs: No additional inputs are needed.

7. Cost involved in the adoption: NIL

8. Remarks:

The special precautions that are to be borne-in-mind while adopting the feed restriction programme are that layers should not be subjected to feed restriction programme as also growing birds that are sick.

1. Title of technology: Induction of lactation in cattle.

2. Experimental evidence:

Infertile heifers and cows can be induced to lactate by injection of reproductive hormones oestrogen and progesterone. In vast majority of cases the animals come to lactation within two weeks after the completion of the treatment. There may be variation in the amount of induction. Natural as well as synthetic oestrogens can be used. The course of treatment recommended is 7 days with natural oestrogens but a period of 14 days was found to be better with synthetic oestrogen. Crystalline progesterone dissolved in oil may be better than other forms. The dosage recommended for seven days' treatment is at the rate of 0.1 mg oestrogen and 0.25 mg progesterone per kg body weight. In 14 days' treatment, the same dose is administered on alternate days.

3. Improvement expected after following the technology

In addition to the benefits of lactation, these animals may come to regular reproductive cycles after the induction. They may conceive on insemination and thus the infertility condition can be overcome.

4. The procedure to be followed by the farmer:

The animals must be in good physical condition at the start of the treatment to get better results. During the treatment, good quality feed must be offered to the animals, as they may reduce feed intake. After the treatment the udder reaches maximum growth within about 14 days and then milking can be started.

5. Infrastructure required: NONE

6. Availability of inputs: The hormones are available for purchase.

7. Cost invclved in adoption of the technology. Cost of hormones will be about Rs. 60/- per medium sized animal.

8. Remarks: Induction has to be done under the supervision of a veterinarian.