



GOVERNMENT OF KERALA

**FINDINGS OF
AGRICULTURAL FIELD
EXPERIMENTS IN KERALA
(1959-60 to 1974-75)**

*BUREAU OF ECONOMICS AND STATISTICS
TRIVANDRUM
FEBRUARY, 1976*



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One of the important items of work attended to by this Bureau is the analysis of Agricultural field experiments conducted by the research stations in various parts of the State Under the auspices of the I. C. A. R., this work was taken up by the Bureau in September 1959 The results of over 1500 experiments conducted in 40 Research Stations have so far been analysed by this Bureau and the results furnished to the I C A R etc The findings of the analysis are sought to be presented in this monograph. This is the first attempt in this direction This paper has been prepared by Shri R. Janardhanan, Research Officer of this Bureau Constructive comments on the monograph will be of help to the Officers of this Bureau for effecting improvements in this type of monographs

Bureau of Economics and Statistics,
Trivandrum,
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Director.

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FINDINGS OF AGRICULTURAL FIELD EXPERIMENTS IN KERALA

Introduction

Augmentation of agricultural production and productivity are the important objectives of our agricultural planning. Exploitation of scientific methods of cultivation is a must for the realisation of these objectives. Agricultural field experiments provide a reliable basis for propagating improved agricultural techniques among farmers. With the launching of Five Year Plans, a good number of Agricultural Research Stations and other experimental centres have been established in different parts of our country under the auspices of Central Ministry of Agriculture, the Commodity Committees, Agricultural Universities and the State Governments. These institutions are engaged in promoting agricultural field experiments on various crops for evolving better techniques in cultivation. As a result the Indian agriculture has shown remarkable improvement in recent years.

The necessity for maintaining the record at one place of the results of the agricultural field experiments conducted all over the country was felt long ago. Further it was decided to collect and compile the data of all the agricultural field experiments (excluding purely varietal trials) conducted at Agricultural Research Stations over the entire country and publish them in the form of compendia periodically for the benefit of research workers. Accordingly the scheme of National Index of Field Experiments was launched during the year 1955 by the Statistical Wing of the I C A R.

So far three compendia volumes (Part I, Part II and Part III) have been published by I C A R. in respect of Kerala State. Part I relates to the period 1948-53, Part II relates to 1954-59 and Part III relates to 1960-65 covering the critical summaries of results of 238, 402 and 612 experiments respectively.

The Statistical analysis of the data obtained from the experiments conducted in the Agricultural Research Stations and Institutions in Kerala was done by the State Directorate of Agriculture till 1959. In September 1959, this work was transferred to the State Bureau of Economics and Statistics. Since then the data on 1512 agricultural field experiments conducted in 40 research stations in the State were analysed statistically and the results were communicated to the following agencies upto the end of 1974-75.

- (1) The concerned Research Stations
- (ii) The State Directorate of Agriculture

37/913/MC

(iii) The Institute of Agricultural Research Statistics (ICAR),
New Delhi

The names of agricultural research stations in the State together with the names of crops on which experiments are conducted in each station are given in Appendix I. The year-wise number of experiments conducted in each research station from 1959-60 to 1974-75 is given in Appendix 2.

It is found that agricultural field experiments were conducted on 29 different crops in the State. The agronomic environment of the agriculture of the State is clearly distinctive from the rest of India. The high rainfall tropical conditions peculiar to the State actually imposes limitations for the utilisation of the technology developed in other States. Besides, several crops grown in the State have only limited All India importance and as such these crops get only limited attention for their research and development needs at national level. All these factors demand greater attention in the development of agricultural research within the State itself and also highlight the limitations in depending upon the technology developed elsewhere.

The crop-wise and type-wise distribution of experiments conducted in the State during the period from 1959-60 to 1974-75 is given in Appendix 3. It is seen that about 65% of the experiments conducted during the period related to paddy crop. As the State is chronically deficit in the production of rice, steps were initiated to enhance its production since the inception of Five-Year Plans in the State. Consequently the annual production of rice has increased from 8.7 lakhs tonnes at the end of First Five Year Plan to 13.3 lakhs tonnes by 1974-75. However, the level of deficit in the case of rice production continues to be about 50% as a result of the growth of population in the State.

The distribution of experiments according to the design adopted in the various research stations are presented in Appendix 4.

Findings

The findings based on statistical analysis of the agricultural field experiments conducted in the various research stations during 1959-60 to 1974-75 are discussed crop-wise in the following paragraphs.

1. PADDY

As pointed out earlier, about 65% of the experiments analysed during the period under reference relate to paddy. This itself is a clear indication of the importance attached to the development of this crop for meeting the growing demands of the people in the State. Different types of experiments viz, varietal, manurial, cultural,

manurta-cum-varietal etc, were carried out in all the eleven rice research stations located in different parts of the State. This is the only crop for which so much number of research stations have been established to conduct various types of field experiments. This being a seasonal crop, experiments were carried out during the 3 seasons viz, Autumn (Virippu), Winter (Mundakan) and Summer (Punja). However, the experiments on summer crop of paddy was held only in rice research stations Mannuthy, Moncompu and Agricultural College, Vellayani. The number of experiments conducted during the 3 seasons in the different rice Research Stations are given in the subjoined table

TABLE I
No. of Agricultural experiments conducted on paddy

Research Station	No of experiments conducted			
	Autumn	Winter	Summer	Total
(1)	(2)	(3)	(4)	(5)
1 Rice Research Station Kayamkulam	142	122		264
2 „ Mannuthy	106	74	4	184
3 „ Kottarakara	29	52		81
4 „ Moncompu		41	60	101
5 „ Pattambi	153	107		260
6 Agronomic Research Station, Chalakudy	15	15		30
7 „ Coyalmanam	11	9		20
8 Agricultural College, Vellayani	4	23	1	28
9 Agricultural Research Station, Ambalavayal	6	1		7
10 Rice Research Station, Vythila.	1			1
11 Agricultural Research Station, Taliparamba	2			2
Total	469	444	65	978

About 54% of the total number of experiments conducted on paddy was done at the two rice research stations of Kayamkulam and Pattambi, each of them shared the experiments more or less equally in number. Just over 37% of the number of experiments were conducted at the Rice Research Stations, Mannuthy, Kottarakara and Moncompu. The number of experiments conducted in the remaining 6 research stations forms only about 9% of the total number of experiments conducted on paddy during the period under reference.

The Research Station-wise and type-wise number of experiments conducted on paddy is given in Table 5 in Appendix 5. The type wise number of experiments conducted on paddy at the 11 Research

Stations in the State during Virippu, Mundakan and Punja is given separately in Table 5 1, 5 2 and 5 3 respectively in the appendix 5

The largest number of experiments was found to be done on Autumn crop of paddy which constitute about 48% of the total number of experiments conducted on paddy. As far as winter crop of paddy is concerned this percentage was about 45. The number of experiments conducted on summer paddy was found to be very few and forms only about 7% of the total numbers of trials carried out.

At the rice research stations Kayamkulam, Kottarakkara, Monkompu and Pattambi in few cases, besides analysing the experimental data on the yield of paddy, the data on the production of straw in the experimental plots were also analysed. The type-wise number of experiments so analysed are given in appendix 6. The number of experiments analysed in these research stations for study of the production of straw are indicated below.

TABLE 2
No. of experiments analysed for the production of straw

<i>Research Station</i>	<i>No of experiments</i>
1 Rice Research Station, Kayamkulam	43
2 " Kottarakara	2
3 " Moncompu	21
4 " Pattambi	20
Total	86

During the period under review 14 different types of experiments were conducted on paddy. Out of 978 experiments analysed, 486 experiments (about 50%) were of Manurial type. Judging from the number of experiments analysed, the other important types of experiments were varietal, cultural, control of pests and diseases and manurial-cum-varietal. The above mentioned types were found to be conspicuous in all the 3 paddy seasons of Autumn, Winter and Summer. Only very few experiments were conducted on irrigational and allied types.

1 1 Varietal:

In 6 out of 11 Rice Research Stations in the State, varietal trials on paddy were held. The total number of varietal trials came to 87 which formed about 8% of the total number of experiments conducted.

on paddy crop. The Rice Research Stations Kayamkulam, Mannuthy, Kottarakara, Moncompu and Pattambi are found to be the important stations where varietal trials on paddy were held. But no varietal trial on paddy was done in Moncompu for Autumn season and in Mannuthy for winter season.

At the Rice Research Station, Kayamkulam 36 varietal trials were conducted mainly with a view (1) to evolve a blast resistant strain by transferring the resistance of Co4 into UR19, (2) to find out the yielding ability of newly evolved exotic strain and its suitability to the tract under dry sown condition and transplanted rice and (3) to study the comparative yielding ability of promising medium and short duration cultures evolved at various Research Stations in Kerala. The varieties tested in 22 experiments were found to be significantly different in respect of their yielding ability. No positive result was obtained in the first category of experiments. In the second category the trials were conducted on the following 9 varieties

1	Jaya	5	IR-8
2	Padma	6.	TN-1
3	Malini	7	Culture 28
4	Masuri	8	PTB-20

In two experiments yield of paddy as well as yield of straw was considered for statistical analysis and found that the highest yield of paddy was produced by PTB 20 in one case and culture 28 in the other case. But as far as the production of straw is concerned, PTB-20 variety turned out to be the highest straw yielding variety in both the experiments. The highest yield obtained are indicated below

TABLE 3

<i>Year</i>	<i>Season</i>	<i>Variety obtained the highest yield</i>	<i>Yield of paddy kg/hect</i>	<i>Yield of straw kg/hect</i>
1970-71	1st crop	Culture 28	3083	
"	"	PTB-20		8222
"	2nd crop	PTB-20	1929	4702

In another similar experiment with the undermentioned 9 varieties, Jagannath variety turned out to be the highest yielding paddy variety while MO3 turned out to be the highest straw yielding strain

1	Triveni	3	Aswathy
2	Jaya	4	Jagannath

5. Pankaj	8 IR5
6 M03	9 IR20
7 H4	

In another experiment consisting of 12 varieties selected from the cross PTB23 and IR8, the variety "culture 29-3" came out as the highest paddy yielding strain while PTB 23 obtained the highest yield of straw.

In an experiment under category 3, consisting of 10 varieties, the variety "203-1-1" was found to have produced the highest paddy yield of 3652 kg/hect. In this case the varieties tried were

1. 203-1-1	6. PYT-16
2. 10 × 1 × 1	7 40-31
3. PRT-56	8 6-4-2
4 79-60	9 PRT 49
5 5-6-2	10 Triveni

During the period under review 16 varietal trials were conducted at Rice Research Station, Mannuthy mainly to test the yielding ability of the different culture evolved in that station along with the newly introduced high yielding strains like, IR8, Jaya, Rohini, Annapurna etc. Experiments were also conducted to test the yielding abilities of the promising cultures of different Rice Research Stations under the Agricultural University of Kerala. Number of varieties put to trial in an experiment varies from 9 to 16. In 14 out of 16 experiments the varieties tested were turned out to be significantly different in their yielding abilities. It was also found that no group of varieties tested once was repeated as such in any other trial at Mannuthy. Name of varieties which showed highest yielding abilities together with the highest yield produced by it are shown below.

TABLE 4

Year	Season	Variety name/No which obtained highest yield	No of varieties tested in each experiment	Yield of paddy kg/hect
(1)	(2)	(3)	(4)	(5)
1. 1969-70	First crop	MN 65-53	16	7156
2. "	"	MN 54-42	11	3133
3. 1970-71	"	Culture 95-97	12	6076
4. "	"	Culture 12035	12	7897
5. "	"	Tachuhg Native 1	12	7512

	(1)	(2)	(3)	(4)	(5)
6	1971-72	First crop	Culture 12035	10	6266
7	"	"	MN 79-60	10	6200
8	1972-73	"	MN 39-31	10	7377
9	"	"	Rohini	9	7018
10	"	"	MN 6948	17	6192
11	1973-74	"	MN 699 (c-2)	10	5177
12	"	"	10 x 1	9	4157
13	1974-75	"	199 A1-1	11	6778
14	"	"	703	11	7044

It is seen from the table given above that culture 12035 variety of Mannuthy emerged as the highest yielding variety in two different trials

At the Rice Research Station, Kottarakara the undermentioned six varieties of paddy were put to trial with a view to test their comparative yielding ability during the winter seasons of 1969-70, 1970-71 and 1971-72. The yielding ability of the varieties tested was found to be significantly different in 2 out of 3 experiments. The varieties on which experiments were done were

- | | | | |
|---|------------|---|-----------------------|
| 1 | Culture 28 | 4 | IR8 |
| 2 | IR262 | 5 | Padma |
| 3 | Jaya | 6 | Culture 29 of cheradi |

The highest yield was recorded in respect of the following varieties

TABLE 5

Year	Variety obtained the highest yield	Yield of paddy kg/hect
1969-70	Culture 29 of cheradi	3366
1971-72	IR 8	4923

Another set of experiments with the following 7 varieties of paddy was conducted at 5 different localities during the 2nd crop season of 1969-70 to compare their yielding abilities

- | | | | |
|---|-----------------------|---|------------------------|
| 1 | T N(1) | 5 | Culture 19 of cheradi |
| 2 | IR8 | 6 | Culture 372 of cheradi |
| 3 | PTB20 | 7 | Local cheradi |
| 4 | Culture 29 of cheradi | | |

The statistical analysis of the data obtained from the experiments revealed that the varieties showed basic difference in their yielding abilities in 3 out of 5 localities and the highest yield in those 3 localities was obtained for IR8 (2651, 4570 and 4099 kgs of paddy per hectare) variety

At the Rice Research Station, Moncompu 14 varietal trials were conducted chiefly with a view to evolve a PTB 10 like strain with additional attributes like dormancy and yield of Athikkira and Thirinjavella under varying levels of manuring—normal manuring and heavy manuring. The performance of the newly introduced Formosan varieties under Kuttanad. The conditions was also tested there. The varietal trials was done mainly during Punja crop season. The results of the trial showed that the varieties put to trial were basically different in their yielding abilities in 7 out of 10 experiments conducted on punja crop of paddy. The varieties which produce the highest yields in the experiments which turned out to be statistically significant on analysis are listed below

TABLE 6

<i>Sl No</i>	<i>Year</i>	<i>Season</i>	<i>Variety name/number which produce the highest yield</i>	<i>Number of varieties tested in each experiment</i>	<i>Yield of paddy kg/hect</i>
1	1966-67	3rd Crop	Co-29	13	5873
2	"	"	A4	9	5053
3	"	"	A-8	8	5716
4	"	"	A12	11	6236
5.	"	"	A12	10	6932
6	"	"	T5	11	7398
7	"	"	T5	10	6139

The varieties with strain numbers A12 and T5 were obtained highest yield in 2 experiments each

1.2 Manurial:

Fertilisar trials were conducted on paddy in almost all the important Rice Research Stations in the State mainly for assessing the response of the crop to the various fertilisers available in the market and also to make sound recommendations on fertiliser use. Application of fertiliser to paddy crop usually results in increased yield of paddy. However, the efficiency of fertilisers can often be increased by applying the fertilisers at the proper time as well as adopting efficient method of its application. For example, nitrogen may be applied at different times, such as planting, period of maximum tillering etc, to get good results. Split application of fertilisers was

found to be more suitable for long duration crops than short duration crops. The same may also be true for heavy soil rather than light soil. Fertiliser can also be applied on surface or at different depths from the surface. It is also found necessary to compare the different sources of the same nutrient after determining the quantity of the nutrient required for the crop. For example, Urea, ammonium sulphate, ammonium sulphate nitrate and calcium ammonium nitrate are the different sources of nitrogen. So experiments were conducted in the various research stations taking all these aspects into consideration. Some of the fertiliser trials repeatedly done in certain important Rice Research Stations are discussed below.

At the Rice research station, Kayamkulam, 4 different types of fertiliser trials were repeated several times. The aim of the experiments and the details of the treatments tested are given in Appendix-71, separately for each category of trials. The first category of experiments was to determine the effect of continuous application of nitrogen both as organic and inorganic as well as phosphatic and potash on the soil fertility and yield of rice. The experiment consisted of 7 treatments. This was repeated 11 times, 5 times during first crop season and 6 times during 2nd crop season. In 10 cases the mean yield of paddy was found to be significantly different due to the effects of treatments. The highest yield rate was obtained for treatment No. 7, viz 40 kg N + 10 kg cattle manure + 30 kg P_2O_5 + 30 kg K_2O in all the 5 experiments done on first crop of paddy and 2 out of 6 experiments done on 2nd crop of paddy. The highest yield was also obtained for treatment No. 1 viz., 40 kg N per hectare as cattle manure, 3 times during 2nd crop season.

The second category of experiments consisting of 12 treatments, were conducted for finding out the effect of split application of Nitrogen on paddy. This was repeated 5 times, 3 times during first crop season and 2 times during second crop season. But only in one experiment in each case it was proved that there existed significant difference in the mean yield of paddy due to the effects of treatments.

In the third category, 6 experiments were conducted 3 each during first crop season and second crop season. Only one experiment conducted during first crop season showed that there was significant difference in the mean yield of paddy due to the difference in the treatments tested. The highest yield corresponds to the treatment No. 5 viz, application of lime 50% basal and 50% in 4 equal instalments.

In the 4th category of experiments, the effect of fractional application of Nitrogen was again tested by repeating the experiment 4 times with 16 different doses. Only one experiment conducted during second crop season indicated that there was significant difference in the mean yield of paddy due to the effect of treatments. The highest yield corresponds to treatment No. 8.

TABLE 7

RICE RESEARCH STATION, KAYAMKULAM

No. of experiments conducted and the treatments correspond to the highest mean yield

Category of Expt	Experiments conducted			Total no of Expts showed significant difference in treatments			No of treatments tested	(a) Treatment no in which the highest yield obtained	No of times in which the highest yield obtained		Highest wt of grain in kg/h obtained in the expt		Remarks
	1st crop	2nd crop	Total	1st crop	2nd crop	Total			Treatment No	1st crop	2nd crop	1st crop		2nd crop
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A	5	6	11	5	5	10	7	T7 T1	5	2 3	3468 2231 1805 2061 3503	1989 2068 NA	
B	3	2	5	1	1	2	12	T2 T6	1	1	2918	3601	
C	3	3	6	1	-	1	6	T5	1	-	2595		
D	1	3	4	-	1	1	16	T8	1			2445	

(a) For details of treatments please see Appendix 7.1

T—Indicates treatment number

The details of number of experiments conducted and the treatments which correspond to the highest mean yield together with the highest mean yield obtained in each category of fertiliser trial held at the Rice Research Station, Kayamkulam are given in table 7 below:

At the agricultural research station, Mannuthy 7 different types of fertiliser trials were conducted. The main objectives of the experiments, and the details of the treatments put to trial are given in Appendix 7 2 separately under each category of trials. The aim of the first category of experiment was to study the effect of continuous application of Nitrogen in the organic and inorganic form with and without phosphorous and potash. The experiment was repeated 12 times, 6 times each during first crop season and second crop season with 7 different treatments. In 11 out of 12 experiments, the mean yield of paddy was found to be significantly different due to the effects of treatments. In 7 cases the highest yield corresponds to treatment No 2 viz, Nitrogen 80 kg./hectare as green leaves.

The effect of split application of Nitrogen on paddy was tested in the 2nd category of experiments. This experiment was repeated 6 times with 12 treatments and with 16 treatments in another 6 times. In the former case in 3 out of 6 experiments, the mean yield of paddy was found to be significantly different due to the effect of treatments and in each case the highest yield was obtained for different treatments. In the latter case, the mean yield of paddy showed significant difference only in two experiments.

The third category of experiment was for testing the effect of fractional application of potash on paddy crop. There were 5 treatments in this group of trials and the same was repeated 4 times. Only in one experiment, the mean yield of paddy showed significant difference due to the effect of treatments.

The fourth group of experiments was to determine the optimum time of application of Ammonium Sulphate to transplanted paddy crop. There were 6 treatments in this category and this experiment was repeated 9 times, six times during the first crop season and 3 times during second crop season. The mean yield of paddy showed significant difference due to the effect of treatments, only in one experiment.

The fifth set of experiments was to study the effect of different levels of N, P, K alone and in combination. The experiment was repeated 6 times, 3 times each during first and second crop seasons.

To study the effect of different levels of N, P, K on paddy crop was the aim for the conduct of the 6th category of experiments. There were 7 treatments in this group of experiments and the experiments were repeated 2 times during the first crop season. In both the experiments, the mean yield of paddy was found to be significantly different due to the effect of treatments. The highest yield was obtained for treatment No. 3 in one case and treatment No. 2 in another case.

The last group of experiment was for studying the effect of application of nitrophosphate complex fertilisers on paddy. This experiment was repeated 6 times, 3 times each during first crop season and second crop season with 3 types of phosphates applied in 3 different methods. The mean yield of paddy showed significant difference due to the effect of treatments only in one out of 6 experiments.

The details of number of experiments conducted and the treatments which corresponds to the highest mean yield together with the highest mean yield obtained in each category of fertiliser trial done at the Rice Research Station, Mannuthy, are given in table 8 below.

TABLE -8-

RICE RESEARCH STATION, MANNUTHY

Number of Experiments conducted and the treatments corresponds to the highest mean yield

Category of Experiment	Experiments conducted			Total No of Experiments showed significant difference in treatments			No of treatments tested	Treatment No in which the highest yield obtained †	No of times in which the highest yield obtained		Highest weight of grain in Kg/Hectare obtained in Experiments	
	1st crop	2nd crop	Total	1st crop	2nd crop	Total			1st crop	2nd crop	1st crop	2nd crop
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	6	6	12	6	5	11	7	T2	4	3	4792 6813 5281 4432	3722 2876 5203
								T7	2	2	4325 2740	5097 4602
B	3	3	6	1	2	3	12	T4 T8 T12 T14	1	1	7212	4622 5791
BI	5	1	6	2		2	16	T16	1		3447	
C	2	2	4	1		1	5	T2	1		5467	
D	6	3	9	1		1	6	T5	1		5932	
E	3	3	6	3	3	6	27	†	3	3	2342 1808 2393	1723 NA NA
F	2		2	2		2	7	T3 T2	1		3240 2874	
G	3	3	6	1		1	27	*	1		2551	

* Main effect of P alone is highly significant

† Main effect of N alone is significant

‡ For details of treatment please see Appendix 7 2

T Indicated treatment number

At the Rice Research Station, Mancompu fertilizer trials were conducted mainly on Punja crop of paddy. The important kinds of fertilizer trials conducted there can be grouped into four. The main objectives and the details of treatments put to trial are given in Appendix 7.3. The first category of experiment was intended to ascertain the superiority of different forms of Phosphatic fertilisers over super phosphate in water soluble form. There were 21 kinds of treatments tested in this category of experiments and the details of which are given in Appendix 7.3. The experiment was repeated two times, one during Punja crop season and the other during Mundakan season. There was significant difference in the mean yield of Paddy due to the effect of treatments. But the highest mean yield was obtained for treatment No. 5 viz, Rock Phosphate 60 lbs/acre in the experiment conducted on Punja crop, while treatment No. 11 viz, Multi Phosphate 60 lbs/acre got the highest mean yield in the experiment conducted on Mundakan crop of paddy.

The second category of experiments was conducted for determining the effect of Nitrogen, Phosphorous (P_2O_5) and lime alone and in their combinations and interactions. The experiments consisted of 12 different treatments formed by 2 levels of N, 2 levels of P_2O_5 and 3 levels of lime. This experiment was repeated 3 times. But the treatments showed significant difference in their effect only in the experiment conducted on Punja crop of Paddy. The highest mean yield was obtained for treatment No. 1 (i.e., N = 33.6 kg/H and P_2O_5 = 44.8 kg/Hectare).

The third category of experiment was to study the nutritional requirements of IR8 under Kuttanad conditions. This experiment consisted of 12 treatments formed by 4 levels of N and 3 levels of P_2O_5 and was done only once on Punja crop of paddy. The result of the experiment showed that there was significant difference in the mean yield of paddy due to the effect of treatments. The highest mean yield was obtained for treatment No. 10 (viz N=120 kg./Hect and P_2O_5 =60kg/Hect).

The fourth category of experiments related to the study on the effect of lime and different source of P_2O_5 on paddy. Two levels of lime and sources of P_2O_5 were tested in the experiment. This experiment was repeated 3 times on Punja crop of Paddy. The results of all the experiments indicated that there was significant difference in the mean yield of Paddy due to the effect of treatments. However, the highest yield was obtained for different treatment combinations in each time.

The details of number of experiments conducted and the treatments which corresponds to the highest mean yield together with the highest mean yield obtained in each category of fertilizer trial done at the Rice Research Station, Mancompu are given in Table 9 below —

TABLE 9

RICE RESEARCH STATION, MANCOMPU

No. of experiments conducted and the treatments correspond to the highest mean yield

Category of Experiment	Experiment conducted			Total No of Experiments showed significant difference in treatments			No of Treatment treatments in which the highest yield obtained		No. of times in which the highest yield obtained		Highest weight of grain in Kg / Hect obtained in the Expt		Remarks
	3rd	2nd	Total	3rd	2nd	Total			3rd	2nd	3rd	2nd	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A	1	1	2	1	1	2	21	T5 T11	1	1	3784	3742	
B	1	2	3	1	..	1	12	T1	1	.	4345	.	
C	1	..	1	1	..	1	12	T10	1	.	6487	.	
D	3	.	3	3	.	3	5	L1 S2 L1 S1 L0 S2	1 1 1		2080 2284 2657		

* For details of treatment please see Appendix 7 3.

T Indicates treatment number

2nd—Second crop of Paddy

3rd—Third crop of paddy.

The largest number of fertiliser trials was conducted at the Rice Research Station, Pattambi during the period under review. The important kinds of fertiliser trials conducted there can be grouped into 9. The main objectives and the details of treatment combinations put to trial are indicated in Appendix 7.4. The first category of experiments was intended to study the effect of continuous application of green leaf and Ammonium Sulphate and their combinations. This experiment consisted of 5 treatments repeated 14 times, 9 times during first crop season and 5 times during second crop season. The results of the experiment showed that there existed significant difference in the mean yield of paddy due to the effect of treatments. During the first crop season in 6 out of 9 experiments, treatment No. 2 viz., 11.2 Tonnes of green leaf per hectare to give 60 kg Nitrogen, produced the highest mean yield of paddy. Only one out of 5 experiments conducted during Winter, treatment No. 5, viz., 73.2 kg per hectare of Nitrogen in the form of Ammonium Sulphate produced the highest yield. This experiment was again repeated 6 times with some difference in the treatment combinations and increasing the number of treatments to 8. Here again the result indicated difference in the mean yield of paddy due to the effect of treatments. However, the highest mean yield was obtained by different treatments each time with an exception of treatment No. 6, which produced the highest mean yield in 2 experiments.

The second category of experiments was for studying the effect of different time of application of Nitrogen to paddy crop. In these experiments 44.8 kg/Hectare of Nitrogen was applied to paddy crop at 6 different times and the experiment was done one time each during first crop season and second crop season. Results of both the experiments revealed that there was difference in the mean yield of paddy due to the effect of different timings in the application of Nitrogen. In both the cases, the highest mean yield was obtained from the experimental plots where $\frac{1}{2}$ the dose of N was applied as basal and $\frac{1}{2}$ the dose of N applied 4 weeks after planting.

To evolve the best combination of different levels of N, P and K for paddy was the aim of the third category of experiments. This experiment was done with 3 levels of N, 3 levels of P_2O_5 and 3 levels of K_2O and was repeated 7 times during first crop season and

one time during second crop season. The results of all the experiments conducted during the first crop season showed that the main effect of N and P are highly significant.

The fourth category of experiments was done for studying the effect of Nitro Phosphate complex fertilisers produced by different processes and applied to previous paddy crop on the succeeding paddy crop. This experiment was done with Nitro Phosphate produced by 2 different processes, 3 levels of fertilisers and 3 methods of application. This experiment was repeated 7 times, 4 times during first crop season and 3 times during second crop season. The main effect of P (different processes of Nitro Phosphate) and L (Levels of fertilisers) was found to be significant in one experiment conducted during first crop season and main effect of L was found to be significant in the experiments conducted during second crop season.

The fifth category of experiments was conducted to study the response of new varieties of paddy to N and select the best variety of paddy seed for double crop wet land. This experiment was repeated 2 times, one time each during first crop and second crop seasons with 6 varieties viz., IR8, IR262, Jaya, Culture 28 (Annapurna) and Padma and 3 levels of Nitrogen. The results of the experiment showed that there was significant difference in the mean yield of paddy due to the effect of varieties and fertilisers. The highest mean yield was obtained for Jaya under 100 Kg of Nitrogen per hectare during first crop season and Annapurna under 120 Kg of Nitrogen per hectare during the second crop season.

To determine whether phosphatic manuring of seedlings in the nursery can serve phosphatic application in the main field was the aim of the sixth category of experiments. This kind of experiments were repeated 8 times, 5 times during the first crop season and 3 times during the second crop season with the application of 4 levels of P_2O_5 at the nursery stage and 5 levels of Nitrogen at the planting stage in the main field. The results of 3 experiments showed that the mean yield of paddy differed significantly due to the effect of application of Phosphatic and Nitrogenous fertilisers. The highest mean yield of paddy, however, was obtained for different treatments in these 3 experiments.

The seventh category of experiments was conducted for comparing the effect of soil and foliar application of Nitrogen to paddy crop. Nitrogen in the form of urea was applied as basal, top dressing and foliar and the experiment was repeated 3 times, 2 times during first crop season and one time during second crop season. The results of these experiments showed that the mean yield of paddy

differed significantly due to the effect of different method of application of Urea. In two experiments, the highest mean yield of paddy was obtained for the treatment No 8 in which the entire quantity of Urea was applied as foliar.

Determining the most appropriate time of application of Nitrogen to IR8 was the purpose behind the conduct of the eighth category of experiments. The dose of Nitrogen was applied to the paddy crop at its different stages of growth, like at initial tillering, at 50% tillering, at maximum tillering etc. This experiment was repeated 2 times with 6 treatments and the results of one experiment above showed that the mean yield of paddy differed significantly due to the effect of the application of Nitrogen at the different stages of the growth of IR8 variety of paddy.

The last category of experiments done at Rice Research Station, Pattambi was to study the efficient use of different levels of Nitrogen at different times of application on paddy crop. In this experiment the dose of Nitrogen varied from 60 to 100 Kg per hectare. Different doses were applied at different stages of growth of paddy. Altogether, the experiment was repeated 6 times, 2 times in the 10 treatment combinations, another 2 times with 12 treatment combinations and yet in another 2 times with 14 treatment combinations. There 3 sets of experiments were done one time each during first crop and second crop seasons. Results of all the experiments showed that the mean yield of paddy differed significantly due to the effects of treatments. However, the highest mean yield of paddy was obtained for different treatments in different experiments.

The details of number of experiments conducted and the treatments which correspond to the highest mean yield together with the highest mean yield obtained in each category of fertiliser trial done at the Rice Research Station, Pattambi are given in Table 10 below.

TABLE 10

RICE RESEARCH STATION, PATTAMBI

No. of Experiments conducted and the treatment correspond to the highest mean yield

Category of Experiments	Experiments conducted			Total No of Experiments showed significant difference in treatments			No of treatments tested	Treatment No in which the highest yield obtained*	No of times in which the highest yield obtained		Maximum weight of Grain in Kg / Hectare obtained in the Experiments		Remarks
	1st crop	2nd crop	Total	1st crop	2nd crop	Total			1st crop	2nd crop	1st crop	2nd crop	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A	9	5	14	6	1		5	T2	6		2789 2749 2592 2506 2789 2749		
								T5	..	1		2041	
A1	4	2	6		1	5	8	T7 T6 T5 T8	2 1 1	1	3382 3008 2107 2867	2787	
B	1	1	2	1	1	2	6	T5	1	1	3115	2065	

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
C	7	1	8	4	.	4	27	.			2644 3314 3758 3673	Main effect on N & P are highly sign- ficant	
D	4	3	7	1	3	4	27		1	3	2153	1612 (Mean yield)	
												1123	”
												810	”
E	1	1	2	1	1	2	18	T8 T12	1	1	3915	4282	
F	5	3	8	2	1	3	20	T20 T5 T4	1 1		4729 4369	4375	
G	2	1	3	2	1	3	9	T8 T1	1 1	1	2549 2517	3274	
H	1	1	2		1	1	6	T3		1		4150	
I	1	1	2	1	1	2	10	T10 T6	1		4579	2859	
I ₁	1	1	2	1	1	2	14	T5 T7	1	1	3222	2635	
I ₂	1	1	2	1	1	2	12	T9 T7	1	1	4827	4965	

* For details of treatment please see Appendix 74

T Indicates treatment number

At the Rice Research Station, Kottarakkara the following important kinds of fertiliser trials were found repeated several times during the period under review

- (1) to study the effect of different method of application of nitrophosphate complex fertilisers on paddy crops
- (2) to find out the optimum time of application of Ammonium sulphate
- (3) to find out the optimum level of lime for paddy
- (4) to find out the optimum dose of N, P and K for paddy

The results of the first 3 kinds of experiments showed that there was no significant difference in the mean yield of paddy due to the effect of treatments tested in those experiments, though the first kind of experiment was repeated 7 times and the second and third kind of experiments were repeated 4 times each

The last category of experiments was conducted with 3 levels of nitrogen, 2 levels of phosphorus and 2 levels of potash and the experiments were repeated 4 times. The results of these experiments indicated that the mean yield of paddy differed significantly due to the effect of treatments. In two experiments effect of Nitrogen alone was found to be significant. In another experiment the effect of nitrogen and potash was found to be significant while the effect of nitrogen and phosphorus was found to be significant in the remaining experiments.

At the Agricultural College and Research Institute, Vellayani the following important types of fertiliser experiments were conducted repeatedly

- (1) to study the effect of different phosphatic fertilisers on paddy in (a) Thottappally area (b) Upper Vellayani Kayal area (c) Mundur-Vaikom area (d) Vadayar-Vaikom area and (e) Lower Vellayani Kayal area
- (2) to select the best form of lime and its economic dose for paddy

The first kind of experiment was done two times for Thottappally area, Vadayar and Upper Vellayani Kayal area and one time each for all other areas. The result of the experiment showed significant difference in the mean yield of paddy due to the effect of treatments in 3 experiments, 2 in Upper Vellayani Kayal area and one in Thottappally area. But the highest mean yield of paddy was obtained for different treatments in different experiments.

The second type of experiments was repeated 6 times with 7 manurial treatments. It was found in 2 out of 6 experiments that

the mean yield of paddy differed significantly due to the effect of the treatments. The highest mean yield in both the cases was obtained for treatment M1 viz, 1121 Kg/hectare of fully burnt lime (Ca O)

13 Cultural:—

In order to compare the efficiency of the cultural practices followed in the cultivation of paddy crop, 81 field experiments were conducted in the different rice research stations in the State during the period under reference. The following are the important aims of the cultural experiments done at the rice research station, Kayamkulam

- (1) To find out the optimum time and frequency of inter culturing the transplanted paddy and
- (2) To find out the best method of sowing and covering seeds

The first category of experiments was repeated two times with 8 times of inter culturing. The results of the experiments showed that the average yield of paddy differed significantly due to the effect of difference in time of inter culturing. The highest yield was obtained from the experimental plots where inter culturing was done 15 days after planting in one experiment and 30 days and 45 days after transplanting in the other experiment. A similar experiment repeated 3 times at Kottarakkara showed that the mean yield of paddy not differed significantly due to the effect of difference in time of inter culturing.

Under the second category 3 experiments were done with 4 methods of sowing. The result of the experiment showed that the average yield of paddy differed significantly due to the effect of difference in the method of sowing in only one experiment in which only 3 method of sowing were used. The highest yield corresponds to the method of sowing "Dibbling behind the country plough and planting"

None of the experiments conducted at the rice research stations, Mannuthy under the cultural type provided any significant difference in the average yield of paddy due to the effects of treatments tested in the experiments.

At the agricultural research station, Pattambi, with a view to compare the efficiency and economy of different methods of planting of first crop of paddy, an experiment with 3 methods of planting was repeated 4 times, one in each year during the years 1959, 1960, 1962 and 1963. The result of the experiments showed that the mean

yield of paddy differed significantly due to the effect of different methods of planting. The highest yield was obtained for planting in double rows at 15 cm \times 15 cm spacing.

1.4 Manurial-cum-varietal —

Manurial-cum-varietal trials were conducted mainly to study whether the improved or high yielding varieties of paddy are more responsive to fertilization. Under this type 80 experiments were conducted at the 5 important rice research stations of Kayamkulam, Mannuthy, Kottarakkara, Mancompu and Pattambi.

At the rice research station, Mannuthy, 3 experiments were conducted to find out the response of high yielding varieties of paddy to different levels of nitrogen. The doses of nitrogen and the varieties of paddy put under trial are indicated below —

TABLE 11

<i>Experiment-I</i>		<i>Experiment-II</i>		<i>Experiment-III</i>	
<i>Dose of N Kg/Ha</i>	<i>Varieties</i>	<i>Dose of N Kg/Ha</i>	<i>Varieties</i>	<i>Dose of N Kg/Ha</i>	<i>Varieties</i>
80	IR 8	50	IR 8	50	IR 8
100	Jaya	80	H 4	80	H 4
120	IR 262	110	Cochin	110	PTB-32
	Padma				
	Culture 28				
	PTB-12				

The experiment No I was repeated 3 times with 18 treatments of application of 3 different doses of N to each of the 6 varieties. The results of these experiments showed that the average yield of paddy varied significantly due to the effects of treatments. The highest yield was obtained for "Jaya" under 120 Kg of Nitrogen per hectare in 2 out of 3 experiments. The result of experiment No. II showed that the mean yield of paddy did not vary significantly due to the effect of treatments. The result of the experiment No. III showed that the mean yield of paddy differed significantly due to the effect of treatments. The highest yield in this case was obtained from IR-8 under the dose of 110 Kg of nitrogen per hectare.

Another 2 experiments were conducted to study the effect of nitrogen on the important PTB varieties of paddy. The experiments were done with 3 levels of nitrogen and six PTB strains of paddy. The results of both the experiments showed that the mean yield of

paddy differed significantly due to the effect of treatments The highest yield on both the cases was derived by the PTB-9 strain with 20 Kg of nitrogen per hectare

At the rice research station, Mancompu 2 experiments were conducted to study the effects of increasing levels of fertiliser application on high yielding varieties of paddy The levels of fertiliser application and the varieties of paddy put under trial are indicated below

TABLE 12

<i>Experiment No I</i>				<i>Experiment No II</i>			
<i>Levels of fertiliser Kg/Hect of N P K</i>			<i>Variety</i>	<i>Levels of fertiliser Kg per hectare of N P K</i>			<i>Variety</i>
L1—40	30	30	IN (1)	L1—40	30	30	Padma
			IR-8				
L2—80	50	50	IR-255	L2—60	40	40	Hamsa
L3—120	70	70	H4	L3—80	50	50	Cul 28
			Jaya				IR-8
			Mashuri				MO3
			MO3				

The result of both the experiments showed that the mean yield of paddy differed significantly due to the effect of treatments The highest mean yield in the first experiment was derived by "IR-255" with 120 70 70 Kg/Ha. of N P K the MO3 strain obtained the highest yield in the second experiment with 80 50 50 Kg/Hec of N P K

At the rice research station, Pattambi, 4 experiments were conducted at 3 different levels of Nitrogen to study the comparative performance of high yielding strains of paddy The results of all the experiments showed that the varieties put under trial were responsive to the different levels of application of nitrogen, as the average yield of paddy was found to be differed significantly due to the effect of treatments in all these experiments The level of nitrogen which corresponds to the highest mean yield of paddy are indicated below:

TABLE 13

Sl No	Level of Nitrogen Kg/Hect	Variety of paddy	Highest mean yield of paddy Kg/Hect
(1)	(2)	(3)	(4)
1	50	IR8	3507
2	50	IR8	3972
3	40	Culture (6-8-8)	3970
4	120	Culture 11812	4428

Another experiment was conducted with 5 levels of nitrogen and 5 varieties of paddy. The result of the experiment showed that the mean yield of paddy differed significantly due to the effect of treatments. The highest mean yield of 5239 Kg of paddy/hect was obtained for IR-262 variety with the application of 200 Kg of Nitrogen per hectare.

For assessing the response of different strains of paddy to different levels of manuring, 2 experiments were also conducted with 3 levels of manuring on different PTB varieties in one experiment, 11 PTB varieties and in the other experiment, 7 PTB varieties were put into trial. The results of the experiments showed that the mean yield of paddy varied significantly due to the effect of treatments. The highest mean yield in the former experiment was obtained for PTB-2 variety of paddy under the manurial level of 5604 Kg of green leaves, 2354 Kg of cattle manure and 112 Kg of Ammonium sulphate per hectare. In the latter case, the highest mean yield was obtained for PTB-15 variety of paddy. The result of this experiment did not provide any evidence that the mean yield of paddy differed significantly due to the effect of different levels of application of manures.

15 Control of pests and diseases

During the period under review 126 experiments were conducted to control pests and diseases of paddy crop. Another 32 weedicidal experiments were also conducted to arrest the growth of weeds in paddy fields. These types of experiments were conducted mainly at the rice research stations, Kayamkulam, Mannuthy, Mancompu and Pattambi. The presentation of findings of these experiments has certain limitations, as the commercial concerns manufacturing pesticides, insecticides, weedicides and other chemicals, with a view to increasing their sales very frequently change the brand names of some

chemicals after slightly changing or modifying the constituents of the ingredients. Further, due to the rapid technical advancement in this branch, new chemical are coming up and replacing the older ones. Accordingly it is felt that the results of these experiments lose their utility subsequently and hence a detailed discussion of the results of the same are not attempted here.

16 Irrigational

With a view to find out the optimum water requirement of paddy crop at different stages of growth, 4 and 6 experiments were conducted at the Agronomic Research Stations, Chalakudy and Coyalmanam respectively. Equal number of experiments were conducted for first and second crops of paddy at both the stations. Levels of irrigation as indicated below were utilised for the experiments.

TABLE 14
Level of standing water in cms

<i>Transplanting to tillering A</i>	<i>Tillering to Flowering B</i>	<i>Flowering to Maturity C</i>
A0 — 0	B0 — 0	C0 — 0
A1 — 2.5	B1 — 2.5	C1 — 2.5
A2 — 5.0	B2 — 5.0	C2 — 5.0

At Chalakudy the results of the experiment showed that during the first crop season, the main effect of B (viz, tillering to flowering) was found to be significant while the main effect of A (viz, transplanting to tillering) was found to be significant during the second crop season in that station. The highest average yield of paddy was obtained for standing water at 5 cms during tillering to flowering during the first crop of paddy. In the case of second crop, the highest yield was derived from the plots where the level of standing water was kept at 2.5 cms from transplanting to tillering of paddy.

The result of the experiments conducted at Coyalmanam showed that the average yield of paddy differed significantly in 2 out of 3 experiments in first crop season and in one out of 3 experiments in the second crop season due to the effect of keeping different levels of water in different stages of growth of paddy. During the first crop season, the difference in average yield was due to standing of water during transplanting to tillering stage in one experiment and in the other experiment it was due to standing of water during flowering to maturity stage. The one experiment in

the second crop season showed that the significant difference in the mean yield of paddy was occurred due to standing of water during transplanting to tillering stage of paddy. The highest mean yield of paddy was derived, from the plots where the water level was kept at 2.5 cms during first crop and 5 cms during second crop season, during the stage of growth of paddy from transplanting to tillering, Keeping the level of water at 2.5 cms, at the stage of growth of the paddy plant from flowering to maturity, also produced the highest mean yield of paddy in one experiment.

17 *Irrigation-cum-Manurial*

At the Agronomic Research Stations, Coyalmannam and Chalakudy, irrigational-cum-manurial type of experiments were also conducted. To study the effect of irrigation and nitrogen on the yield of paddy 4 and 5 experiments were conducted at Chalakudy and Coyalmannam respectively with 4 levels of irrigation and 3 levels of nitrogen. The results of only 2 experiments conducted at Coyalmannam showed that the mean yield of paddy differed significantly due to the effect of treatments. In one experiment the main effect of nitrogen and in the other experiment the main effect of irrigation were found to be significant. The highest mean yield of paddy in the former case was obtained from the plots applied with 80 kg per hectare of nitrogen. The highest mean yield of paddy in the other case was obtained from the plots where the level of standing water was kept at 6 cms.

2 LEMONGRASS

There is only one research station for the conduct of field experiments on lemongrass in Kerala. The research station is established at Odakkali in Ernakulam district. The research station is engaged in the conduct of 3 types of field experiments. They are (1) varietal, (2) manurial and (3) cultural. The randomised block design was adopted for the conduct of the experiments in a very big majority of the cases. The other design followed was split plot design and factorial design. In a good number of cases besides analysing the data on the yield of grass from the experimental plots, the data on the yield of lemongrass oil extracted from the grass obtained from the experimental plots as well as the citral content of the oil obtained were also analysed. In all 109 experiments were conducted there and on statistical analysis of the experimental data, it was found that only 42 of them were turned to be statistically significant.

Data on 29 varietal trials were analysed so far but the varieties tested in 9 of them only were found to have any basic difference in yielding grass or oil. The important varietal trial conducted for lemongrass are discussed below.

The experiments were repeated thrice for selecting the best varieties with regards to the production of grass and oil and the percentage content of citrus in the oil, with the following two groups of varieties during the years 1969-70, 1970-71 and 1971-72 (group A) and 1968-69, 1969-70 and 1970-71 (group B)

<i>Group—A</i>			<i>Group—B</i>		
1	OD.	19	1	OD	19
2	„	191	2	„	56
3	„	193	3.	„	70
4	„	198	4	„	98
5	„	224	5	„	99
6	„	225	6	„	123
7	„	239	7	„	142
8.	„	240	8	„	143
9	„	241	9.	„	148
10	„	242			
11	„	260			

As far as group A, is concerned, only in 2 out of 3 experiments, the varieties tested were shown significant difference in their yielding ability of grass. In one trial the variety "OD 242" got highest yield of grass while in the other trial the variety "OD 198" recorded the highest yield of grass. But in all the 3 experiments, variety "OD 191" came out to be the highest oil yielding variety.

In the case of group B the variety "OD 148" recorded the highest yield of grass in all the 3 trials, besides, it emerged as the highest oil yielding variety in one experiment. In one experiment, the oil yielding ability of the varieties listed was found to be not significant. The variety "OD 98" came out as the highest oil yielding variety in the remaining one experiment.

Manurial experiments were conducted with the main objective to find out the optimum dose of compost and ash to be applied to lemongrass in order to get the maximum yield at a reduced expenditure. With the following manurial combinations, the experiment was repeated 4 times.

Manurial combinations (treatments)

- (i) 1000 Kg compost + 750 Kg ash—(per acre per annum)
- (ii) 2000 Kg compost + 750 Kg ash—(per acre per annum)
- (iii) 4000 Kg compost + 750 Kg ash—(per acre per annum)
- (iv) control

The data obtained from the first two experiments held in 1968-69 and 1969-70 did not provide any evidence that the treatment combinations tested were capable of producing any difference both in the case of production of grass and oil. But the other 2 experiments conducted during 1970-71 and 1971-72 revealed that the manurial combination No. 3 given above, produced the highest yield of grass. The yield of oil was found to be significantly different, only in the 4th year and the highest yield of oil corresponds to treatment No. 1.

The maximum number of experiments on lemongrass was conducted for the improvement of its cultural practices. These experiments were mainly aimed at (1) to determine the optimum interval to be given between the harvests for the best yield and (2) to find out whether the yield rate can be increased and citral content improved by adopting the optimum density of population—that is spacing required for plants. During the period under review the former category of experiments was repeated 7 times and the latter 5 times. The cultural practices followed for the two categories of experiments are indicated below.

Category—I

- | | | | |
|-----|------------|-------|---------------|
| (1) | Harvesting | 30-35 | days interval |
| (2) | „ | 40-45 | „ |
| (3) | „ | 50-55 | „ |
| (4) | „ | 60-65 | „ |

Category—II

- | | | | |
|-----|---------|----------|-----|
| (1) | Spacing | 15 × 10 | cms |
| (2) | „ | 15 × 15 | cms |
| (3) | „ | 15 × 22½ | cms |
| (4) | „ | 15 × 30 | cms |

As far as the first category of the cultural practices are concerned, the statistical analysis has revealed in 5 out of 7 experiments, that the harvesting interval between 60 to 65 days had produced the maximum yield of grass and in respect of this interval the citral content of the oil was also found to be maximum in 4 out of 7 experiments. The yield of oil was found to be maximum in respect of the harvesting interval of 40 to 45 days and 60 to 65 days in two experiments each.

Though the experiments under category 2 (spacing trial) were conducted 5 times at the rate of one experiment in an year from 1968-69 to 1972-73 the results of the experiment conducted during 1971-72 alone had shown significant difference between the different

spacing tried. The highest yield of grass and oil was recorded in respect of the spacing 15×10 cms while the other two types of spacings were found to be equally good for the highest, citral content of the oil (18%)

3 VETTIVER

It is reported that field experiments on this crop are carried out in two research stations in the State. They are lemongrass research station, Odakkali and Vettiver research station, Thiruvambadi. The total number of experiments so far analysed for this crop amounts to 40, of which only two experiments were done at Thiruvambadi. The type of experiments conducted on this crop was the same as those conducted on lemongrass viz, varietal, manurial and cultural.

Varietal trials were conducted to select the genetically superior type of Vettiver from among the following 6 varieties

- | | |
|----------------|-----------------------|
| 1 Musanager | 4 Musanager (Chlomus) |
| 2 Nilambur | 5 Bharathpur |
| 3 North Indian | 6 Malabar |

On analysis of the yield data it was found in 2 experiments that the "Nilambur" variety was basically different from the other 5 varieties in the case of production of roots.

With a view to determine the effect of P_2O_5 as super phosphate and K_2O as Muriate of Potash in three levels singly and in all combinations on the yield of root and oil, 6 experiments were conducted one each during 1963-64, 1964-65, 1965-66, 1968-69, 1970-71 and 1972-73. Data obtained from the experiments on the yield of root and oil were analysed separately. The main effects of P was found to be significant only in one experiment conducted during 1964-65 at Thiruvambadi, as far as the yield of root was concerned. Similarly the main effect of P was found to be significant in the case of yield of oil only in another experiment conducted there during the year 1965-66.

Like lemongrass, many number of experiments were conducted for cultural practices for this crop also. Under cultural type 25 experiments were analysed taking the data on root and oil separately. These experiments were mainly to determine (1) the correct stage of harvest of Vettiver for maximum yield and (2) the best time for planting Vettiver so as to get the maximum yield. The experiments with the former aim were repeated 8 times and the experiments with latter aim was repeated for 4 times. The type of cultural practice followed in these two category of experiments are given below.

Category—I

1	Harvesting 11 months	after planting
2	"	12 "
3.	"	13 "
4	"	14 "
5.	"	15 "
6.	"	16 "
7	"	17 "
8	"	18 "

Category—II

1	Time of Planting—May
2	" —June
3	" —July
4	" —August
5	" —September
6	" —October

The analysis of the first category of experiments revealed in 4 out of 8 experiments that the best stage of harvest is 17 months after planting as far as the yield of roots is concerned. In the case of oil, it was found that the difference in the yield of oil was significant, only in 4 experiments and out of which 3 were in favour of harvesting plants after 18 months of planting.

In the second category, the analysis of data of the experiments showed in 3 out of 4 cases that there was significant difference in the mean yield of root and oil due to the difference in the time of planting of Vettiver. In two experiments, the highest yield of root was obtained from the vetiver planted in May and the 3rd experiment indicated that the highest yield was obtained from the Vettiver planted in June. In the case of oil yield, May, July and August were found to be favourable months for planting Vettiver as one experiment each was found to have obtained highest yield of oil from the Vettiver planted in May, July and August.

4 CITRONELLA

At the lemongrass research station, Odakkali, 3 experiments were also reported to have conducted on citronella, one experiment each during 1970-71, 1971-72 and 1972-73. All the 3 experiments belonged to varietal type. The data obtained from the experimental plots in the production of grass and the oil extracted from that grass were analysed separately. In all the 3 experiments, the following 4

varieties of citronella were tested with regards to its production capability of grass and oil

Varieties of citronella tested

- | | |
|---------------------|---------------|
| (1) Kashmir | (3) Ceylon |
| (2) Central America | (4) Nilambur. |

The statistical analysis indicated that in all the 3 experiments, the 4 varieties were basically different in their yielding capabilities of oil and in all the cases the highest yield of oil was obtained from the Central American variety. The production of grass was found to be differed significantly in two cases only. In one experiment the Central American variety produced the highest yield and in the other the Ceylon variety obtained the highest yield.

5 CASTER

One varietal trial consisting of 12 varieties was conducted on castor at the Integrated seed Development Farm, Eruthampathy in 1966-67. The experiment indicated significant difference in the yield of castor and the highest yield of 1666 Kg of castor per hectare was found to have produced by the variety "NC-6"

6 SESAMUM

Field experiments on Sesamum were conducted at the following research stations

- (1) Integrated seed development farm, Eruthampathy
- (2) Oil seed Research Station, Kayamkulam

Only 3 types of experiments, viz, varietal, Manurial and cultural were conducted on Sesamum in the State. Number of experiments conducted on the crop amount to 36, during the period under reference. Out of the 16 varietal trials, 15 were conducted at Kayamkulam. There, 4 groups of varieties were found to have been tried repeatedly two times or more to find out the best suitable variety to the locality. Under the first group 12 varieties were tested twice, one each in 1971-72 and 1972-73. Both the experiments showed that the varieties tested were significantly different in their yielding abilities and the highest yield was obtained for "Multipoded mutant of Kayamkulam—1" variety in both the cases.

Another set of 12 varieties were put into trial in the second group of experiments and repeated in 3 consecutive years from 1968-69 at the rate of one experiment in each year. The difference in the mean yield of these varieties was found to be significant only in one experiment conducted during 1969-70. The highest yield was obtained for the "Onattukara Local" variety. Only 8 varieties were

tested under group three. Though the experiments were repeated 5 times, the difference in the average yield of sesamum was found to be significant, only in one experiment. The highest mean yield in this case was obtained for "Culture-6" variety of sesamum. In the last group only 7 varieties were put to trial and this experiment was repeated 4 times. The difference in the mean yield of sesamum was found to be significant only in one experiment and the highest yield in this case was also obtained for the variety "Culture-6".

Fertilizer trials were conducted on sesamum with the following 3 objectives (i) To find out the effect of urea as foliar and soil application at different concentrations (ii) To find out the effect of N₂ to the yield of sesamum (iii) To find out the effect of different nitrogenous fertilisers to the yield of sesamum

The first objective was tested in 3 experiments consisting of the following 6 treatments, one experiment each in 1969-70, 1970-71. and 1971-72.

- (i) Urea entire dose (82 gm) as basal dressing
- (ii) Urea half dose (41 gm) as basal and half as top dressing 20 days after sowing
- (iii) Urea half dose (41 gm) as basal and half (41 gm) as foliar application
- (iv) Urea entire dose (82 gm) as soil application—20 days after sowing
- (v) Entire dose of urea as foliar application—20 days after sowing
- (vi) Spraying water 20 days after sowing

The difference in the mean yield of sesamum turned out to be significant in the experiments conducted on the later two years. In both those experiments the highest mean yield of sesamum was due to the effect of treatment No. 3 viz, urea half dose (41 gm/per hect) as basal and half dose (41 gm/hectare) as foliar application. The highest yields obtained for this treatment are indicated below

TABLE 15

<i>Year</i>	<i>Name of fertilizer combination</i>	<i>Yield of sesamum Kg/Hect</i>
1970-71	Urea $\frac{1}{2}$ dose as basal and $\frac{1}{2}$ dose as foliar	284
1971-72	"	296

Two experiments were conducted one each in 1971-72 and 1972-73 with a view to facilitate the 2nd objective given above. The following 5 treatment combinations were used for the experiments —

- (1) N—nil
- (2) N—15 Kg/Hect (urea)
- (3) N—30 Kg/Hect („)
- (4) N—45 Kg/Hect („)
- (5) N—60 Kg/Hect („)

In all the above treatments, Super Phosphate, and Muriate of Pottash were added as basal manure. Both the experiments were turned to be significant as far as the mean yield of sesamum was concerned. The highest yield of sesamum was obtained for the Nitrogen dose of "N-30 Kg/Hect." in the two experiments and the same are indicated below.

TABLE 15A

<i>Year</i>	<i>Dose of Nitrogen</i>	<i>Yield of sesamum Kg/hect</i>
1971-72	N—30 Kg/hect	340
1972-73	„	342

With the 3rd objective in view, 2 experiments were conducted, one each in 1970-71 and 1971-72 with 8 treatment combinations. The mean yield of sesamum was turned out to be significantly different due to the effect of the fertiliser combinations tried. In both the experiments the highest yield of sesamum as indicated below was obtained for the treatment, N—30 Kg/hect.

TABLE 16

<i>Year</i>	<i>Dose of Nitrogen</i>	<i>Yield of sesamum Kg/hect</i>
1970-71	N—30 Kg/hect	393
1971-72	„	213

Cultural type of experiments were conducted on sesamum to determine the proper time and optimum number of inter culture for the crop. The experiment was repeated thrice one each in 3 consecutive years from 1968-69 with the following agricultural operations in 8 different times.

- (1) Inter culture 15 days after sowing
- (2) " 25 "
- (3) " 35
- (4) " 15 & 25 ,
- (5) " 15 & 35 "
- (6) " 25 & 35 "
- (7) " 15, 25 & 35 ,"
- (8) Control

Only one out of 3 experiments confirmed that the data on yield of sesamum had shown significant difference due to the effect of basic difference in the cultural practices followed. Inter culture 15 and 35 days after sowing indicated the highest mean yield of sesamum.

7 GROUNDNUT

Only at the Integrated Seed Development Farm, Erathumpathy, field experiments on groundnut were carried out in the State for suggesting improvements on the method of cultivation of this important oil seed. During the period under review only 14 experiments were conducted, 6 on varietal type 2 on manurial type and 6 on cultural type. The following two groups of varieties of groundnuts were put into trial separately to test the yielding ability of each of them.

Group I

- (1) Trivandrum-1
- (2) AM-334
- (3) Spanish peanut
- (4) B₁ Japan
- (5) AK-10

Group II

- (1) Trivandrum-2
- (2) Red Pollachi
- (3) C-501
- (4) Faizpan

These two groups of varieties were tested 3 times each in 1966-67 at the research station. The Statistical analysis indicated that the varieties tested were interspecifically different in their yielding ability as the data on yield of groundnut showed significant difference in all the experiments. In the first group of varieties, Trivandrum-1 variety, showed highest yield in all the 3 experiments. In the 2nd group Faizpan obtained highest yield in 2 experiments and Red Pollachi obtained the highest yield in one experiment.

With a view to formulate a manurial schedule for *Red Pollachi* variety of groundnut, 2 manurial experiments were conducted one in 1964-65 and another in 1965-66. The experiment conducted in 1964-65 alone had shown that the manures tested were significantly different in the case of yield of groundnut.

Cultural experiments were conducted (1) to find out proper spacing, and (2) to determine suitable time for sowing of groundnut. With the former objective, 4 experiments were conducted and 2 experiments were conducted with the latter objective. The spacing followed in the first set of experiments are as follows:

- (1) 30 cm × 10 cms
- (2) 30 cm × 15 „
- (3) 30 cm. × 20 „
- (4) 30 cm × 25 „
- (5) 30 cm × 30 „

On analysis of the yield data it was found that 3 out of 4 experiments were not provided any evidence that the spacing followed were capable of effecting significant difference in the yield of groundnut. But the experiment conducted during 1965-66 showed that the spacing followed were significantly different in the case of production of groundnut. The highest mean yield of 929 kg groundnut per hectare obtained in the experiment which corresponds to the spacing 30 cms × 10 cms

For facilitating the second objective, 2 experiments were done in 1964-65 using the following dates for sowing groundnuts

- (1) 15-4-1965
- (2) 30-4-1965
- (3) 15-5-1965

Both the experiments showed that there was significant difference in yield of groundnut due to the difference in the date of sowing and the highest yield corresponds to the sowing date 30-4-1965 in these two experiments

8 BANANA

In the research stations listed below, field experiments on banana were conducted during the period under review

- (1) Agricultural Research Station, Ambalavayal
- (2) Banana & Pineapple Research Station, Kannara
- (3) Banana Research Station, Mannunthy
- (4) Banana Research Station, Trichur.

The number of different types of experiments conducted on banana are indicated below

<i>Type of experiment</i>	<i>No of experiments</i>
(1) Manurial	18
(2) Cultural	5
(3) Cultural-cum-Manurial	6
(4) Irrigational	4
Total	33

Manurial experiments were done mainly with a view (1) to find out the effect of liming and optimum dose of fertiliser (2) to study the effect of N,P, and K applied singly and in combination, and (3) to study the effect of Lime and N, P and K fertilizers

Under the first objective 4 experiments were conducted with 3 levels of lime and 3 levels of manures as indicated below:

- L0 = No lime
- L1 = 600 kg of lime/hectare
- L2 = 1200 kg. „
- M0 = No manure
- M1 = 700 kg of manure/hectare
- M2 = 1400 kg of „

Nine different combinations of the above treatments were tested. The yield date of banana was found to be significantly different only in two out of 4 experiments. In both these experiments the highest yield was obtained for the fertilizer combination of LO M2

Under the second objective 4 experiments were conducted with 3 levels of N, P & K as indicated below:

- No=No Nitrogen
- N1=114 gm/plant
- N2=228 gm/plant
- P0=No P₂ O₅
- P1=114 gm/plant
- P2=228 gm/plant
- K0=No K₂O
- K1=228 gm/plant
- K2=456 gm/plant

In all these experiments the effects of N1 K1 were found to be significant

Under the third objective 3 experiments were conducted at 3 levels of lime and 3 levels of fertilizers as indicated below:

Levels of Lime

- Lo = No lime
- L1 = $\frac{1}{2}$ kg Lime/plant
- L2 = 1 kg lime/plant

Levels of Fertilizers

- Mo = No fertiliser
- M1 = 114 gm of N + 114 gm of P + 228 gm of K/plant
- M2 = 2 M1

In all the cases main effect of M was found to be significant

For evolving suitable method of cultivation of Banana, 5 experiments were conducted, 3 for ascertaining the best season for planting and 2 for ascertaining the best method and season for planting. The first 3 experiments were conducted after grouping months separately under each of 3 categories as shown below.

- 1 Category I—May & June
- 2 Category II—August & September
- 3 Category III—October & November

In all the 3 experiments the yield data of Banana indicated significant difference due to the difference of time of planting. But the highest yield of banana was obtained for the banana planted during May-June in one experiment, August-September in another experiment and October-November in the remaining experiment.

To ascertain the best method and season of planting banana, 2 experiments were conducted by planting the crop in the following 3 methods during each of the months from September to February.

Method of Planting

- (1) Planting in pits
- (2) " Trenches
- (3) " on ground level

The experiments were conducted during 1969-70. The analysis of the yield data indicated that there was significant difference in

the methods followed and the months selected for planting banana. In both the experiments, the highest yield was recorded from the crop, planted in trenches in the month of October.

Under cultural-cum-manurial type, six experiments were conducted chiefly for the purpose of (1) to find out the optimum spacing and the best level of fertilizers, (2) to find out optimum manurial dose and plant population, (3) to study the comparative merits of suckers of different sizes under fresh and dry conditions and (4) to study the effect of cultural and manurial treatments on the crops.

Four facilitating the first objective, 3 experiments were conducted, but the analysis showed that the treatments tried were not differed significantly in producing basic difference in the yield of banana. As far as the other objectives are concerned only one experiment each was conducted for the purpose.

To determine the best method and interval of irrigation for banana crop, 4 experiments were conducted, 2 in 1969-70 and 2 in 1971-72 at Kannara. But none of the experiment showed that the yield of banana differed significantly due to the effect of irrigation.

9 PINEAPPLE

At the Banana and Pineapple Research Station, Kannara, field experiments were conducted mainly of manurial, cultural and manurial-cum-cultural types on pineapple crop in the State. Of the 25 experiments conducted during the period under review 13 belonged to manurial type, 2 belonged to cultural type and 10 belonged to cultural-cum-manurial type.

Manurial trials were conducted with the following 2 aims:

(i) To find out the effect of liming and the optimum doses of fertilisers.

(ii) To find out suitable combinations of major plant nutrients (N P K).

With a view to determine the first objective 4 experiments were conducted adopting the same dosage of lime and manures as given to the Banana crop for similar experiments. In 3 out of 4 experiments the yield data of pineapple showed that there was significant difference between the treatments tested. The highest yield in experiments was due to the treatment LO M2.

With the following 3 levels of N, P and K, (27 treatments) field experiments on pineapple was repeated nine times.

- 1 3 levels of N—N₀ = 0, N₁ = 80, N₂ = 160 kg/hectare
- 2 3 levels of P₂ O₅—P₀ = 0, P₁ = 40, P₂ = 80 kg/hectare
- 3 3 levels of K₂O—K₀ = 0, K₁ = 160 K₂ = 320 kg/hectare

In some cases yield data of pineapple were analysed separately for weight of fruits and number of fruits. It was found in all the cases that there was significant difference in the mean yield rate of pineapple due to the effect of nitrogen. In some cases the combined effect of phosphorous and potash was also found to be significant.

The yield data of cultural trial conducted on Pineapple had showed that the various depth followed for planting Pineapple suckers were not differed significantly to produce any significant impact in the mean yield of pineapple.

To determine optimum spacing and best level of fertilisers on pineapple the undermentioned combinations of treatments were repeated in 6 experiments and the yield data obtained both in weight and number of fruits were analysed separately.

- (1) 3 spacings — S1 = 45 cms × 60 cms.
 S2 = 37 „ × 53 „
 S3 = 30 „ × 46 „

(2) 2 Manurial levels

M1 = 50 kg/hectare of N + 25 kg/hectare of P₂O₅ + 100 kg./hectare of K₂O

M2 = 2M1

The mean yield Pineapple both by weight and number of fruits was found to be significant only in one experiment due to the effect of treatments. The highest yield was obtained for the treatment M2 S3.

10 PEPPER

Field experiments on pepper crop were conducted in the undermentioned Research Stations in the State:

- (1) District Agricultural Farm, Neriyamangalam
- (2) Agricultural Research Station, Taliparamba
- (3) Oil Palm Research Station, Thodupuzha

Varietal, manurial and cultural were the important types of experiments conducted in these Research Stations. Varietal trials were conducted mainly of two types. The first type was to find out the comparative performance of different kinds of planting materials with regards to yield and longevity. Rooted vines of running shoots, hanging shoots and main shoots were used for the experiments. The experiments were repeated 4 times. The results of the experiments showed that the mean yield of pepper was not significantly different due to the effect of difference in the planting material. The second type of experiment was conducted for evolving a best variety from

among the 8 popular varieties. This type of experiments also repeated 4 times and the results of all these experiments showed that the mean yield of pepper differed significantly due to the difference in the varieties of pepper. "Narayacodi" variety of pepper got the highest mean yield in 3 out of 4 experiments.

Only 2 manurial trials were conducted on pepper for determining the optimum manurial requirements but the results of both of them showed that the mean yield of pepper not differed significantly due to the effect of treatments tested in the experiments.

The largest number of experiments conducted on pepper was related to cultural types mainly with the following aims:

(1) To determine the best method of pruning and training the pepper vines

(2) To determine the optimum economic cultural requirement for pepper crop

(3) To determine the optimum pruning treatments of *Eythrina indica* standards for proper growth of pepper vines

The experiments with the first objective were conducted at Neriya Mangalam and Thodupuzha. The result of the 8 experiments conducted in both stations showed that the mean yield of pepper not differed significantly due to the effect of 5 different methods of pruning followed.

As far the second aim is concerned, 3 experiments were conducted at Talparamba with 5 cultural treatments. The result of the one experiment alone showed that the mean yield of pepper differed significantly due to the effect of the different cultural practices followed. The highest yield was obtained for the cultural practices of digging twice for the culture plot in August-September and October-November.

With 3 cultural treatments of lopping of pepper standards 3 experiments were conducted for the realisation of the third aim given above. In this case also the results of only one experiment showed that there existed significant difference in the mean yield of pepper due to the effect of treatments. The highest yield was obtained from the pepper standards which were not subjected to lopping of either all branches or half the number of branches.

11. COCONUT

During the period under review, field experiments on coconut were conducted in the undermentioned Research Stations in the State:

- (1) Regional Coconut Research Station, Kumarakom
- (2) Central Coconut Research Station, Nileswar

(3) Regional Coconut Research Station, Neyyattinkara

(4) Agricultural Research Station, Pilicode

Only two types of experiments viz, manurial and cultural were conducted on this perennial crop. Of the two types, manurial experiments formed the largest number of experiments. But the results of a good number of experiments showed that the mean yield of coconut not differed significantly due to the effects of treatments tested in the experiments.

At the Regional Coconut Research Station, Neyyattinkara an experiment was conducted to study the residual effect of N, P and K applied in the previous years to coconut, with six manurial combinations on West-Coast Variety of coconut. The experiment covered 6 plots of 8 trees each. The residual effect studied from 1960 and continued during 1961 and 1962. The results of the experiment conducted during 1961 alone showed that the mean yield of coconut differed significantly due to the effects of treatments. The highest yield of 816 nuts per plots was obtained for the fertilizer dose of 230 gm N + 340 gm P₂O₅ + 680 gm K₂O per tree. A similar experiment was also conducted at Regional Research Station, Kumarakom on West-Coast tall variety. The residual effect studied from 1960 to 1965. The yield data for 1960 and 1961 are not available. The result obtained from the experiments conducted during the 4 years from 1962 to 1965 also confirmed that the fertilizer dose 230 gm N, 340 gm P₂O₅ and 680 gm K₂O per tree produced the highest yield. The highest mean yield—average number of nuts per plot—obtained are indicated below.

TABLE 17

Year	Manurial combination	Average number of Nuts per plot
1962	230 gm N, 340 gm P ₂ O ₅ and 680 gm K ₂ O per tree	377.3
1963	,	327.6
1964	„	268.3
1965	,	257.0

In another experiment conducted at Kumarakom to determine a suitable and economic dose of N, P, K for coconut, with 6 different fertilizer doses on 6 plots of 8 trees each, it was found that there existed significant difference in the mean yield of coconuts due to effects of treatments. The highest yield of 497 nuts per plot was obtained for the fertilizer dose of 200 gm of N, 300 gm of P₂O₅ and 500 gm of K₂O per tree.

With a view to study whether cultural practices have any effect on the performance of coconut, field experiments were conducted at the Regional Research Station, Kumarakom for four years from 1962 to 1965 with four cultural operations on 4 plots of 12 trees each. The result of the experiments conducted during the 3 years from 1963 to 1965 showed that the mean yield of coconut per plot differed significantly due to the effect of the cultural practices. The highest yield obtained in the 3 experiments are indicated below.

TABLE 18

<i>Year</i>	<i>Cultural Practices followed</i>	<i>Average yield of coconut per plot</i>
1963	2 digging annually, first in August-September and 2nd in December-January	487.5
1964	"	521
1965	Clean removal of surface grass	577.0

A similar experiment was also repeated during the year 1968-69 there and the results showed that the mean yield of coconut per plot differed significantly due to the effect of cultural practices. The highest mean yield of 36 nuts per tree was obtained from the plots where 2 digging were done annually.

12 CASHEW

Varietal type of experiments, numbering 8, alone was conducted on cashew in the only Cashew Research Station, Anakkayam. The most important experiment was conducted to compare the yield of promising types of cashew. The experiment was repeated 4 times with 7 varieties of cashew during the 3 years consecutively from 1969-70 to 1971-72. The result of the combined analysis of the data showed that the mean yield of cashew differed significantly due to the effect of the varieties in 2 out of 4 experiments. The highest yield was obtained for the "12 A RCRS Kottamkara" variety in one experiment and in the other experiment Anakkayam local variety obtained the highest yield.

13 GINGER

Field experiments on ginger crop were conducted in the Agricultural Research Station, Ambalavayal/Central Horticultural Research Station, Ambalavayal and Oil Palm Research Station, Thodupuzha. The important types of experiment conducted include varietal, manurial, cultural, cultural-cum-manurial and control of pests and diseases.

In one experiment 21 varieties, and in another experiment 9 varieties were used to conduct varietal trials. The results of these experiments revealed that the mean yield of ginger differed significantly due to the effect of the varieties. In the first experiment conducted during 1967-68, Thudanganad variety obtained the highest yield of 6438 kg per hectare. In the second experiment conducted on 1970-71, "Rio-de-Jenero" variety obtained the highest yield.

Manurial experiments were conducted mainly for (1) to study the effect of different levels of N, P, K and lime alone and in combination in ginger, (2) to study the effect of different levels of nitrogen in organic and inorganic form on Ginger. The former category of experiments was repeated 4 times at Thodupuzha with 3 levels of N, P, K and lime on local (medium) varieties of ginger. The results of the experiments showed the mean yield of ginger differed significantly due to the effect of P. The highest yield corresponds to the application of 67 kg per hectare of Super Phosphate.

The latter category of experiments was repeated 2 times at Thodupuzha with 2 levels of nitrogen obtained from 6 sources on local (medium) varieties of ginger. The result of one experiment showed that the average yield of ginger differed significantly due to the effect of nitrogen and the highest yield of 61 quintals per hectare of ginger corresponds to the application of 168 kg of nitrogen per hectare.

Cultural type of experiments was conducted with the following important objectives on Ginger.

- (1) To determine the best time of planting
- (2) To find out the optimum stage for harvest
- (3) To find out optimum spacing
- (4) To find out the best method of storing seed ginger for obtaining healthy rhizomes

With a view to realise the first objective 4 experiments were conducted at Thodupuzha with the following 4 dates of planting of Ginger.

- (1) First April
- (2) 15th April
- (3) First May
- (4) 15th May

The results of the 3 out of 4 experiments showed that the mean yield of ginger differed significantly due to the difference in the planting dates. The highest yield corresponds to the different planting

dates of First April, 15th April and First May in each of these experiments

At the Research Station, Ambalavayal 2 experiments were conducted for the realisation of the second objective. But the results of these experiments did not provide any evidence to show that the average yield of ginger differed significantly due to the effect of harvest dates from 215 to 275 days after planting.

With the third objective in view, 2 experiments were conducted at the Central Horticultural Research Station, Ambalavayal in 1961 and 1962, with the following 5 spacings for planting Wynad variety of Ginger

- (1) 15 × 15 cms
- (2) 23 × 15 "
- (3) 23 × 23 "
- (4) 30 × 23 "
- (5) 30 × 30 "

The results of these experiments also did not provide any evidence that the average yield of Ginger differed significantly due to the difference in the spacing provided in the experiments

As far as the fourth objective is concerned, one experiment was conducted with 6 methods of storing seed ginger. The result of the experiment revealed that the average yield of ginger differed significantly due to the difference adopted in the storing seed ginger. The highest mean yield of 130.6 quintals per hectare of ginger was obtained from the method of "heaping ginger on the floor in a room"

One cultural-cum-manurial type of experiment was repeatedly done at Thodupuzha during the 3 years from 1960 to 1962 to study the effect of different spacings and sizes of seed material in combination with different levels of manures on local (medium) variety ginger with 6 different spacings, 3 seed sizes and 2 levels of manure. The results showed that the average yield of ginger differed significantly due to the effect of different spacing and size of seed material. The highest yield of 78.9 quintals of ginger per hectare was obtained for spacing 15 cm × 15 cm and seed size varying between 3.8 cm to 5.1 cm

Under the type "controlling the pests and diseases", 2 experiments were conducted at Ambalavayal and 4 experiments were conducted at Thodupuzha, to find out the effect of different fungicides in controlling of soft-rot disease on ginger. At Ambalavayal

5 fungicidal treatments were used while at Thodupuzha only 4 fungicidal treatments were used in the experiments. But only the result of one experiment conducted at Ambalavayal showed that the average yield of ginger differed significantly due to the effect of application of different fungicides. The highest mean yield of 118.7 quintals per hectare of ginger was obtained for the fungicide formed by pouring chestnut compound 28 gm in 9 litres of water.

14 CARDAMOM

Only two experiments were reported to have been done on this crop at the Cardamom Research Station, Pampadumpara. They were of cultural types. The aim of the experiment was to find out the best spacing required for the crop. The following 3 spacing was adopted in the experiment for planting rhizomes of cardamom.

- (1) 2 m × 2 m
- (2) 3 m × 3 m
- (3) 4 m × 4 m

The result of the experiments showed that the average yield of cardamom varied significantly due to the difference in spacing adopted in planting rhizomes. The highest mean yield was obtained from the cardamom rhizomes planted with 2 m × 2 m spacing.

15 OIL PALM

Field experiments on this crop was carried out at the Oil Palm Research Station, Thodupuzha. The important trials conducted there belonging to the manurial type. The main objective of the manurial trial was to determine the N, P, K and Magnesium requirements of Oil Palms. By the combination of N, P and K at two levels and Magnesium at 3 levels 18 different fertilizer combinations were made for the experiments. The experiment was started in 1969 and continued for 4 years up to 1972. In each of these years, 3 separate sets of experiments were conducted with two replications. The data on the weight of oil palm bunches obtained from each experiment were analysed statistically for every year. The result did not provide any evidence that the mean yield of oil palm bunches varied significantly due to the effects of treatments during the first 3 years from 1969 to 1971. But in the fourth year result of all the experiment indicated significant difference in the mean weight of oil palm bunches due to the effect of treatments. The highest mean yield was obtained for treatment No 7 (viz., N70 P70 K140 M35) in the first set of experiments and for the other 2 sets of experiments the highest mean yield was obtained for the treatment No 11 (viz., N 70 P0 K0 M0).

Cultural experiments were also conducted one for studying the optimum depth at which the seedlings should be planted for easy establishment, quick growth and maximum yield and the other for studying the effect of inter crops and cover crops on the yield of oil palm. The result of the second experiment showed that the mean weight of oil palm bunches differed significantly due to the effect of cover cropping. The highest mean yield was obtained from the experimental plots inter crop with moong.

16 REDGRAM AND BLACKGRAM

At the Pulses Research Station, Sasthamkottah 2 cultural experiments were conducted one on redgram and the other on blackgram. In the case of redgram the experiment was conducted to determine the best time of sowing. The experiment was done with 5 different dates of sowing from 15th June to 25th July 1965. The result of the experiment revealed that the mean yield of redgram varied significantly due to the effect of difference in sowing dates. The highest yield of 65 kg per hectare of redgram was obtained from the plots where the date of sowing was 5th July.

As far as the blackgram is concerned, the experiment was to find out the optimum spacing to get highest yield. In the experiment 6 different spacings were tried. The result of the experiment did not provide any evidence that the mean yield of blackgram varied significantly due to the effect of spacing.

17 COWPEA

A similar cultural experiment as that done on blackgram was conducted for cowpea at Sasthamkottah. In this case also the result of the experiment did not provide any evidence that the mean yield of Cowpea varied significantly due to the effect of spacing.

18 BHINDI

At the Agricultural Research Station, Vellayani, 2 experiments were conducted to find out effective pesticides to control pests on Bhindi during 1960 and 1961 with different kinds of insecticides. The result of the experiments did not provide any evidence that the mean yield of Bhindi varied significantly due to the effect of insecticides.

19 SWEET POTATO

At the Tuber Research Station, Mannuthy, 3 manurial trials were conducted to determine the best combination of N, P and K for Sweet Potato, during the years 1960 to 1962. The treatment combination consisted of 2 levels of N and 3 levels of P₂O₅ and K₂O. The main effects of N and P were found to be significant in

the experiment conducted in 1960. The highest yield of 6298 kg per hectare of Sweet Potato was obtained for the treatment consisted of N 90 kg/hectare and P₂O₅ 112 kg/hectare.

In the experiment conducted during 1961, the main effect of N alone was found to be significant. The highest yield was obtained for the treatment having Nitrogen at 90 kg/hectare. Similarly in the experiment conducted during 1962, the effects of N and K were found to be significant. The highest yield corresponds to treatment having Nitrogen at 90 kg/hectare and potash at 179 kg/hectare.

The cultural type of experiment was conducted to determine the optimum spacing and the best method of cultivation of sweet potato. The experiment was repeated for 4 years during 1960, 1961, 1962 and 1964 with 2 methods of planting and 3 kinds of spacing. The result of the experiment showed that the mean yield of potato varied significantly due to the effect of treatments. The highest yield of 6418 kg per hectare of sweet potato corresponds to the planting of sweet potato on ridges at 61 cm × 15 cm spacing.

20 TAPIOCA

Field experiments on Tapioca were conducted in the following research stations —

- (1) Tuber Research Station, Mannuthy
- (2) Tapioca Research Station, Thruvalla
- (3) Tapioca Research Station, Trivandrum

The important type of experiments conducted at the above mentioned research stations were of cultural-cum-manurial type aiming at the determination of the best doses of N, P and K and the best spacing of Tapioca. The experiments were conducted on the following varieties of Tapioca with 3 levels of N, P₂O₅, K₂O and 4 kinds of spacings —

TABLE 19

Name of Research Station	Varieties of Tapioca		
	1960	1961	1963
1 Mannuthy	H—105	Malayan—4	
2 Thruvalla	T—37 (Nedumangadan)	T—37 (Nedumangadan)	T—37 (Nedumangadan)
3 Trivandrum	M—4	M—4	

The result of the experiments done at the 3 research stations mentioned above revealed that the average yield of tapioca differed significantly due to the effect of fertilisers and spacings. The details of the result obtained from these experiments are listed below -

TABLE 20

<i>Research Station</i>	<i>Name of manure and spacing produced the highest yield</i>	<i>Highest mean yield of Tapioca quintals/ hect</i>
1 Mannuthy	168 Kg /hect of N and spacings 61 x 61 cms	141.8
2 Thiruvalla	67 Kg /hect of P ₂ O ₅ and spacings 90 cm x 90 cm.	181.1
3 Trivandrum	168 Kg /hect of N and spacings 60 cm x 60 cm	252.7

21 SUGARCANE

The important field experiments conducted on sugarcane were of manurial type. During the period under reference the experiments were done at the following 2 research stations

- (1) Sugarcane Research Farm, Thiruvalla
- (2) Sugarcane Research Farm, The Travancore Sugars and Chemicals, Thiruvalla

The experiments were carried out chiefly with the objectives of (1) to study the effect of N, P, K and lime and (2) to study the effect of P and K on the yield of sugarcane.

At the sugarcane research farm, Thiruvalla 2 experiments were done, one in 1960 and the other in 1961 to study the first objective. After applying 112 Kg/hectare of nitrogen to all the plots, 3 levels of P₂O₅ and K₂O were used in the experimental plots of CO-449 variety sugarcane. The results of the experiments showed that the average yield of sugarcane varied significantly due to the effect of K. The highest mean yield corresponds to 224 Kg per hectare of K₂O.

With regards to the second objective, 3 experiments were conducted on CO449 variety sugarcane one each in 1959, 1960 and 1961 at the sugarcane research farm, Travancore Sugars and Chemicals, Thiruvalla. In the experiment 3 levels of P₂O₅ and K₂O were

applied. The results of the experiments did not provide any evidence that the average yield of sugarcane vary significantly due to the effect of treatments.

Two experiments were also conducted at the Sugarcane research station, Thiruvalla, one for studying the best time of application of Potash and the other to study the effect of lime and different levels of P and K on the yield of Sugarcane. Results of both the experiments showed that the average yield of sugarcane differed significantly due to the effect of treatments. In the first experiment, the highest yield of sugarcane was obtained from the plots where 1/4 dose of Potash applied at the time of planting, 3/8 two months after planting and 3/8 four months after planting. In the second experiment the highest yield was obtained from the plots where the dose of application of potash was 224 Kg per hectare.

22 TOBACCO

Tobacco research station Kanhangad is the only station established in the State to conduct research on tobacco. Manurial experiments were conducted there with the objectives given below —

- (1) To study the effect of different levels and times of application of nitrogen on the yield and quality of tobacco
- (2) To study the effect of organic manures on the yield and quality of tobacco
- (3) To fix up a manurial schedules for chewing tobacco

With a view to study the first objective given above, 2 experiments were conducted with 3 levels of N as fish manure and 3 times of application on PAUNAN variety of tobacco. The results of the experiments revealed that the average yield of tobacco differed significantly due to the effect of time of application of manures. The highest mean yield was obtained from the experimental plots where manure was applied 1/3 dose after 15 days, another 1/3 dose after 30 days and the residual dose after 15 days of transplanting of tobacco.

For the realisation of the second objective, 3 experiments were done one each in the year of 1960, 1961 and 1962 with 10 sources of 235 Kg per hectare of N and 2 levels of P_2O_5 as superphosphate. The results of the experiment showed that the mean yield of tobacco varied significantly only due to the effect of application of P_2O_5 . The highest yield correspond to the dose of 56 kg of P_2O_5 per hectare.

As far as the third objective is concerned, 3 experiments were also conducted with 3 levels each of N, P and K. But the result of

the experiment did not provide any evidence that the average yield of tobacco varied significantly due to the effect of the treatments

Under the cultural type, 2 experiments were conducted to study the effect of different spacings and topping on the yield and quality of tobacco with 3 kinds of spacings and 3 numbers of leaves topped per plant. The result of the experiment did not provide any evidence that the mean yield of tobacco varied significantly due to the effect of spacing and topping followed in the experiments

Another set of 3 experiments were also done under cultural-cum-manurial trials for finding out the effect of spacing and different levels of N on the yield of tobacco. The experiment was conducted with 3 kinds of spacings and 3 levels of N. Results of one experiment showed that the average yield of tobacco varied significantly due to the effect of spacings as well as the applications of N. The highest yield corresponds to the dose of 50 Kg per hectare of N and spacing 120 cms x 70 cms. Results of another experiment showed that the yield of tobacco varied significantly only due to the effect of spacings. The result of the third experiment did not provide any evidence that the mean yield of tobacco varied significantly due to the effect of application of N and different spacings followed in it.

23 VANILLA

At the agricultural research station Ambalavayal, field experiments on Vanilla were conducted. Under the manurial type, 2 experiments were conducted to study the effect of manures on blossom fruit setting and crop yield. With two sources of N and Lime the experiments were done in 2 years 1963 and 1964. The result of the experiment did not provide any evidence that the mean yield of crop varied significantly due to the effect of N and lime.

Under the cultural type, experiments were conducted with following important objectives

(1) To determine the optimum length of planting materials required for better growth and its influence on the pre-leaving period of the vine

(2) To determine the best method of training the vanilla vines and

(3) To determine the best standard for vanilla

As far as the first objective is concerned 3 experiments, one each during the year 1960, 1961 and 1962 were conducted with 4

lengths of rooted cuttings. The result of the experiment showed that in all the experiments the average number of leaves in vines differed significantly due to the difference in length of planting material. The largest number of leaves was obtained from the rooted cuttings planted with a length of 122 cms in 2 out of 3 experiments.

To determine the best method of training the vanilla vines, 4 experiments were conducted one each in the 4 consecutive years from 1960 to 1964 with 3 methods of training vines. The result of these experiments did not provide any evidence that the 3 methods of training of vines were differed significantly.

The third objective was put into trial in 2 experiments with five types of standards. The results of these experiments, also did not provide any evidence that the 5 types of standards used in the experiments differed significantly.

Under the irrigational-cum-cultural type, 4 experiments were conducted to study the effect of pot watering during summer months and mulching throughout the year on vanilla vines with 4 frequencies of irrigation and 2 cultural treatments. The results of 2 out of 4 experiments showed that the average length of vine was differed significantly only due to the effect of mulching the vine.

24 EUCALYPTUS

Manurial and cultural trials on eucalyptus were conducted at the agricultural research station, Ambalavayal. To determine the optimum dose of cattle manure for eucalyptus citriodora, 2 experiments were conducted with 4 levels of cattle manure. The result of the experiment revealed that the average yield of leaf was significantly different due to the effect of application of cattle manure. The highest average yield of leaf was obtained for the dose of 44.8 kg of cattle manure per plant.

For determining the optimum interval for pruning of eucalyptus for obtaining maximum oil yield, 2 experiments were conducted with 10 intervals of pruning. The results of both the experiments showed that the average yield of leaf and oil differed significantly due to the effect of pruning interval. In one experiment the highest mean yield of leaf was obtained for 11 months interval of pruning while in the other experiment 8 months interval of pruning produced the highest yield of leaf.

25 MANGO

On experiment was conducted at the agricultural research station, Taliparamba for comparing the influence of monoembryonic and poly-embryonic root-stocks, with the 6 kinds of root stocks of one year old listed below

<i>Treatment</i>	<i>Scion</i>	<i>Root stock</i>
1	Bennet Alphonso	Chandrakaran
2	Benishan	do
3	Bennet Alphonso	Bappakai
4	Benishan	do
5	Bennet Alphonso	Puliyani
6	Benishan	do

Girth of stock and height and spread of scion were taken as quantitative observation. The results of the experiment showed that the treatment differences were highly significant.

26 SAPOTA

At the agricultural research station, Taliparamba, one experiment was conducted from 1954 to 1959 to determine the most suitable root-stock for sapota with the following 3 treatments

<i>Treatment</i>	<i>Scion</i>	<i>Root stock</i>
1	Local sapota	Local sapota
2	do	Bassialongifolia
3	do	Manatharahexandra

Girth stock and height of scion were taken as quantitative observation. The result of the experiment showed that the mean height in cms per tree differed significantly due to the effect of treatments.

27 COFFEE

Manurial and cultural experiments were conducted on Coffee at the Coffee demonstration farm, Kalpetta and Coffee research station, Malathottom. The experiments were also conducted at Chellotte estate, Krishna estate and North Carolina estate at Kalpetta.

To study the effect of dose and time of application of N, P and K on Coffee, 2 experiments were conducted at the Coffee demonstration farm, Kalpetta with 3 levels of N, P and K and 3 numbers

of application. The results of the experiment showed that the mean yield of coffee differed significantly due to the effect of application of fertilisers as well as the number of time of application of fertilisers. The highest yield of coffee seeds was obtained for the fertiliser combination of 180 N + 120 P + 160 k kg/hect in 3 applications (Pre-blossom, pre-monsoon and post monsoon)

With a view to study the effect of manuring on Coffee, 8 experiments were conducted 2 each at Chellotte estate, Krishna estate, North Carolina estate and Malathottom estate during the year 1960 and 1961. The experiments were done with 4 levels of N and 4 months of application of manure. The results of 2 out of 8 experiments showed that the average yield of coffee seeds varied significantly only due to the effect of methods of application of manures.

For studying spacing for coffee 2 experiments were conducted one each during 1964 and 1965 with 6 spacing at the coffee demonstration farm, Kalpetta. The result of the experiment conducted during 1965 alone showed that the average yield of coffee differed significantly due to the effect of spacings. The highest yield was obtained for the spacing 94 cms x 91 cms.

28 RUBBER

Field experiments on rubber were conducted in the under-mentioned rubber estates

- (1) Mundakayam Estate, Kottayam
- (2) Malankara Estate, Kottayam
- (3) Vaikundam Estate, Kottayam
- (4) Udukade Estate, Kottayam

To determine the optimum requirements of N, P and K for rubber, 8 experiments were conducted, 2 each in the above mentioned estates during the year 1963 and 1964. In all these experiments 3 levels of N, P and K were used. The results of the experiments showed that in 6 out of 8 experiments the main effect of P was found to be significant. In all these 6 experiments, the largest average girth measurement was obtained for the dose of 89.6 kg P_2O_5 per tree.

29 MIXED CROPPING

At the pulses research station, Sasthamkotta, an experiment was conducted to find out the economics of mixed cropping of tapioca and horsegram. It was conducted with the following 3 treatments

- (1) Tapioca alone
- (2) Horsegram alone
- (3) Horsegram and tapioca mixed

The result of the experiment showed that the average profit per hectare differed significantly due to the effect of treatments. The highest profit of Rs 192 1 per hectare was obtained from mixed crop of tapioca with horsegram.

CONCLUSION

Nearly 8% of the total number (978) of experiments conducted on paddy crop belonged to Varietal type. This type of experiments were done mainly at the rice research stations, Kayamkulam, Mannuthy, Kottarakkara and Moncompu. It was found that the under-mentioned varieties of paddy obtained the highest mean yield in the various trials conducted in these stations to test the yielding abilities of promising varieties of paddy.

TABLE 21

Varieties of paddy corresponding to the highest mean yield

<i>Rice Research Stations</i>	<i>Name or strain No of the varieties corresponding to the highest mean yield of paddy</i>
1 Kayamkulam	Culture 28, PTB 20, Culture 29-3, 203-1-1-
2 Mannuthy	MN-65-53 MN 54-42 MN-79-60 MN 39-31 MN 6948 MN 699 (C2) 199 A1-1 703 Rohini, Taichung Native-1 Culture 95-97, Culture 12035 10 x 1 x 1
3. Kottarakkara	Culture 29 of Cheradi, IR 8
4. Moncompu	CO-29, A4 AB, A12 T 5

In order to assess the response of paddy crop to different fertilisers and to evolve the most suitable dose of fertilisers for paddy, manurial trials were conducted on paddy in almost all the important rice research stations in the State. The different kinds of fertiliser doses responsible for producing the highest mean yield of paddy at the different rice research stations are listed below.

TABLE No 22

Dosages of fertiliser which correspond to the Highest mean yield

<i>Rice Research Stations</i>	<i>Aim of Experiments</i>	<i>No of times experiments repeated</i>	<i>Dosages of fertiliser which correspond to the highest mean yield of paddy</i>	<i>No of times fertiliser dosages obtained highest yield</i>
(1)	(2)	(3)	(4)	(5)
1 Kayamkulam	(1) Continuous application of Nitrogen both organic and inorganic with and without P ₂ O ₅ and K ₂ O	11	(1) 40 Kg of N+10 Kg of cattle manure + 30 Kg of P ₂ O ₅ + 30 Kg of K ₂ O per hectare (2) 40 Kg of N/Ha as cattle manure	7 3
	(2) Split application of Nitrogen	5	(1) 75% basal+12 1/2% PI + 12 1/2% booting (2) 50% tillering + 25% booting + 25% heading	1 1
	(3) Fractional application of Lime	6	50% basal+50% in 4 equal instalments	1
	(4) Fractional application of Nitrogen	4	50% basal + 25% tillering+25% at PI Stage	1
2 Mannuthy	(1) Continuous application of Nitrogen both organic and inorganic with and without P ₂ O ₅ and K ₂ O	12	(1) 80 Kg N/Ha as green leaf	7
			(2) 80 Kg N/Ha, 1/2 as Ammonium Sulphate and 1/2 as green leaf and P ₂ O ₅ and K ₂ O @ 50 Kg/ha as superphosphate and muriate of potash.	4

@ Meaning "at the rate of"

(1)	(2)	(3)	(4)	(5)
	(2) Split application of Nitrogen	12	Percentages of N at different stages of Planting Tillering PI Boot- Head- ing ing	
			1 2 3 4 5	
			1 75 12 5 12 5 1	
			2 50 2 5 25 1	
			3 20 20 20 20 1	
			4 50 25 25 1	
			5 25 25 25 25 1	
	(3) Factorial application of Potash	4	Potash 100% as basal	1
	(4) Time of application of Ammonium Sulphate	9	$\frac{1}{4}$ as Basal dressing and $\frac{3}{4}$ one month before planting	1
	(5) Effect of different levels of N, P, K alone and in combination	6	50 4 Kg Nitrogen/Ha	4
	(6) Effect of N, P, K and its different services.	2	1 40 Kg N/Ha as green leaf	1
			2 40 Kg, N/Ha as Ammonium sulphate + 30 Kg, P ₂ O ₅ /Ha. as super sulphat	1
	(7) Effect of Nitrophosphate complex fertilisers produced by different processes	6	Super phosphate	1
3	Moncompu	1	Effect of different phosphate fertilisers	2
			1. Rock phosphate @ 60 Lbs/acre	1
			2. Multiphosphate @ 60 Lbs/acre.	1
	2. Effect of N, P ₂ O ₅ and lime alone and in combination	3	33 6 Kg Nitrogen as Ammonium sulphate + 44 8 Kg as super phosphate per hect.	1
	3) Nutritional requirement of IR 8 under Kuttanad conditions	1	120 Kg of N/Ha + 40 Kg of P ₂ O ₅ /Ha	1

(1)	(2)	(3)	(4)	(5)
	(4) Effect of Lime and different sources of P	3	(1) 1121 Kg of slaked lime + 44.8 Kg of Hyper phos/Ha (2) 1121 Kg of slaked lime + 44.8 Kg of super phos/Ha (3) 44.8 Kg of Hyper phos/Ha	1 1 1
4	Pattambi			
	(1) Application of green leaf and Ammonium Sulphate and their combination	14	(1) 11200 Kg of green leaf/Ha to give 60 Kg of N (2) Ammonium Sulphate to supply 73.2 Kg of N	5 1
	(2) Application of green leaf, cattle manure and Ammonium Sulphate	6	(1) C M + GL each @ 2000 lbs/acre and N, P, K to supply 20 Lbs/acre each as Ammonium Sulphate, Super phosphate and Muriate of Potash (2) 4000 Lbs of G L / acre and N, P, K as in (1) above. (3) 4000 Lbs of CM/ acre and NPK as in (1) above (4) Ammonium Sulphate to supply 40 lbs N and super to supply 20 lbs of P ₂ O ₅ /acre.	1 2 1 1
	(3) Effect of different sources and time of application of Nitrogen	2	44.8 Kg of N/Ha $\frac{1}{2}$ dose as basal and $\frac{1}{2}$ dose 4 weeks after planting	2
	(4) Evolve best combination of different levels of N, P and K for paddy	7	1 16.8 Kg of N, as Ammonium sulphate /Ha 2 50.4 Kg of N do 3 50.4 Kg of N do plus 33.6 Kg of K ₂ O as muriate of Potash	1 2 1
	(5) Effect of Nitro phosphate complex fertilizers produced by different processes	7	(1) Single super + 53.8 Kg /ha of N + 47.1 kg /ha. of P ₂ O ₅ (2) 53.8 Kg /ha of N + 47.2 Kg /ha of P ₂ O ₅	2 2

(1)	(2)	(3)	(4)	(5)
	(6) Test whether phosphate manuring of seedlings can serve phosphate application in the main field	8	(1) 90 Kg per hectare of N while planting in the main field	1
			(2) 120 Kg /ha of N while planting in the main field	1
			(3) 90 Kg /ha of P ₂ O ₅ in the Nursery stage + 120 Kg /ha of N while planting in the main field	1
	(7) Compare the effect of soil and foliar application of Nitrogen (in the form of urea)	3	(1) Foliar application of urea in 4 equal interval	2
			(2) $\frac{1}{2}$ dose of urea as basal and $\frac{1}{2}$ dose as top dressing in 3 equal interval	1
	(8) Determine the time of application of Nitrogen to IR8	2	$\frac{1}{2}$ the dose of N at planting stage and $\frac{1}{2}$ the dose at P I stage	1
	(9) Efficient use of different levels of Nitrogen at different times of application	6	Percentage of N at different stages of	
			Basal Tillering P-I Booting	
			(1) (2) (3) (4)	
			1 50 25 - 25	1
			2 60 20 20	1
			3 75 25	1
			4 50 50	1
			5 50 25 25	1
			6 33 33 34	4
5	Kottarakkara (1) Dose of N P K	4	(1) 50 Kg /ha of N	1
			(2) 44 8 Kg /ha. of N	2
			(3) 40 Kg /ha of N + 30 Kg /ha of P.	1

Only very few experiments conducted under the cultural type, showed significant difference in the mean yield of paddy due to the effect of the different cultural practices followed in the experiments. The cultural practices which correspond to the

highest mean yield of paddy in the important cultural trial conducted in the various Rice Research Stations are indicated below —

TABLE 24

Cultural practices which correspond to the highest mean yield of paddy

<i>Rice Research Station</i>	<i>Cultural practices which correspond to the highest mean yield of paddy</i>
1 Kayamkulam	1 Inter culturing 15 days after planting 2 Inter culturing 30 & 45 days after planting 3 <i>Method of sowing</i> —Dibbling behind the country plough and planking
2 Pattambi	<i>Method of planting</i> —planting in double rows at 15 cms x 15 cms spacing

Manurial-cum-Varietal trials were held mainly to study whether the improved or high yielding varieties of paddy are more responsive to fertilisation. The analysis showed that 61 out of 80 experiments under this type obtained statistically significant results. The varieties of paddy and the manurial doses which correspond to the highest mean yield of paddy in this type of experiments conducted at the important Rice Research Stations in the State during the period under reference are given below.—

TABLE 25

Varieties and Fertiliser doses correspond to the highest mean yield of paddy

<i>Rice Research Station</i>	<i>Highest mean yield obtained from</i>	
	<i>Varieties of paddy</i>	<i>Fertiliser doses</i>
(1)	(2)	(3)
1 Mannuthy	Jaya IR-8 PTB-9	120 Kg /Ha of Nitrogen 110 Kg /Ha of Nitrogen 20 Kg /Ha of Nitrogen
2 Moncompu	IR-255 MO ₃	120 70 70 Kg /Ha of NPK 80 50 50 Kg /Ha of NPK
3 Pattambi	IR-8 Culture (6-8-8) Culture (11812) IR-262 PTB-2	50 Kg /Ha of Nitrogen 40 Kg /Ha of Nitrogen 120 Kg /Ha of Nitrogen 200 Kg /Ha of Nitrogen 5604 Kg of green leaves + 2354 Kg of cattle manure + 112 Kg of Amonium Sulphate per hectare.

At the Agronomic Research Stations, Chalakudi and Coyalman-nam, few irrigational experiments were conducted. At Chalakudy, it was found that the highest average yield of paddy was derived from the plots where the level of standing water was kept at 5 cms from tillering to flowering stage during the first crop season and in the case of second crop the level of standing water at 2.5 cms from transplanting to tillering stage resulted the highest mean yield. But at Coyalman-nam, the highest mean yield of paddy was derived from the plots where the water level was kept at 2.5 cms during first crop and 5 cms during second crop season, at the stage of growth of paddy plant from transplanting to tillering.

At the lemongrass research station, Odakkali, the different varietal trials showed that "OD 242", "OD 198", and "OD 148" varieties are the highest lemongrass yielding varieties while "OD 98", "OD 148" and "OD 191" emerged as the highest lemongrass oil yielding varieties. The maximum number of experiments on this crop was conducted for evolving the best cultural practices viz, (1) interval between harvests and (2) spacings of plants. The harvesting interval between 60 to 65 days had produced the maximum yield of grass. The highest yield of grass and oil was recorded in respect of the spacing 15 x 10 cms.

As far as "Vetiver" is concerned Nilambur variety turned out to be the highest root yielding variety. In the cultural trials, it was found that, harvest of 17 months after planting yielded the best results. It was also found that the highest yield of root was obtained from the Vetiver planted in May and June.

The varietal trials conducted at oil seed research station, Kayamkulam showed that the highest mean yield of sesamum was obtained from, "multipoded mutant of Kayamkulam I" "Onattukara Local" and "Culture-6" varieties. Manurial trial conducted there revealed that 30 kg/hectare of Nitrogen had produced the highest mean yield of sesamum. The best dose of urea for the crop was found to be 81 gm/hectare, $\frac{1}{2}$ the dose (41 gm/hectare) as basal and $\frac{1}{2}$ the dose (41 gm/hectare) as foliar application. As far as cultural practices are concerned that inter culture 15 and 35 days after sowing indicated the highest mean yield of sesamum.

In the case of Banana 18 manurial experiments were analysed under 3 different categories. In the first category 1400 gm/hectare of manure had produced the high mean yield of Banana in 2 out of 4 experiments. In the second category of experiments all the 4 experiment showed that the highest average yield of Banana was obtained for 144 gm/plant of N and 228 gm/plant of K_2O . In the

last category, the application of 228 gm of N + 228 gm of P + 456 gm of K per plant resulted in the highest mean yield of banana

In the varietal trials conducted on pepper revealed that "Narayacodi" variety obtained the highest mean yield in 3 out of 4 experiments. The result of one out of 3 cultural experiments showed that the highest mean yield of pepper was obtained for the cultural practice of digging twice for the culture plot in August-September and October-November. In another set one out of 3 experiments showed that the highest mean yield of pepper was obtained from the pepper standards which were not subjected to lopping of either all branches or half the number of branches.

The important types of experiments conducted on the perennial crop of coconut were manurial and cultural. A good number of manurial experiments showed that the mean yield of coconut did not differ significantly due to the effects of treatments tested in the experiments. But one experiment conducted at the Regional Research Station Neyyattinkara from 1960 to 1962 and another experiment conducted at the Regional Research Station, Kumarakom from 1960 to 1965 to study the residual effects of fertilisers on West Coast Variety showed that there was significant difference in the mean yield of coconut due to the effect of treatments. The highest mean yield of coconut was obtained for the fertiliser dose of 230 gm N, 340 gm P_2O_5 and 680 gm K_2O per tree. In another experiment at Kumarakom, it was found that the highest mean yield of coconut was obtained for the fertiliser dose of 200 gm of N, 300 gm of P_2O_5 and 500 gm of K_2O per tree. A cultural experiment conducted at Kumarakom from 1963 to 1965 and again repeated during 1968-69 showed that the highest mean yield of coconut was obtained from the plots where 2 diggings were done annually, first in August-September and second in December-January.

Regarding Ginger, the varietal trials showed that the highest yielding varieties were "Thudanaganad" and 'R o-de Jenciro'. In the manurial trials it was found that the highest mean yield of Ginger corresponds to the fertiliser dose of 67 kg per hectare of Super phosphate (in 4 experiments) and 168 kg of nitrogen per hectare (in another 2 experiments). In a cultural experiment to study the best method of storing ginger, it was found that the highest mean yield of ginger was obtained from the method of 'heaping ginger on the floor in a room'.

The cultural-cum-manurial trials conducted during 1960, 1961 and 1963 at the Tuber Research Station, Mannuthy, and Tapioca Research Stations Tiruvella and Trivandrum showed that the highest

mean yield of Tapioca corresponds to fertiliser dose and spacings given below—

TABLE 26
Fertiliser dose and spacings of Tapioca

<i>Research Station</i>	<i>Fertiliser dose and spacing produced the highest mean yield of Tapioca</i>	<i>Variety of Tapioca put under trial</i>
1 Mannuthy	168 Kg of N/Ha and spacings 61 x 61 cms	H—105 and M4
2 Thiruvella	67 Kg of P ₂ O ₅ /Ha and spacings 90 x 90 cms.	T—37 (Nedumangadan)
3. Trivandrum	168 Kg of N/Ha and spacings 60 x 60 cms	M4

As far as the remaining crops covered by this report are concerned, it is found that the number of trials conducted for them are inadequate to derive any worthwhile conclusions

APPENDICES

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LIST OF APPENDICES

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Paddy
 - 5 1 No of Agricultural Field Experiments analysed according to type—Paddy I
Crop
 - 5 1A No of Agricultural Field Experiments obtained statistically significant results—
Paddy I Crop
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 - 5 2A No of Agricultural Field Experiments obtained statistically significant results—
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-

APPENDIX I

<i>Agricultural Research Stations</i>		<i>Experimental Crops</i>
1	Rice Research Station, Kayamkulam	Paddy
2	Do Mannuthy	Paddy
3	Do Kottarakkara	Paddy
4	Do Moncompu	Paddy
5	Do Pattambi	Paddy
6	Agronomic Research Station, Chalakudy	Paddy
7	Do Coyalmannam	Paddy
8	Agricultural College, Vellayani	Paddy, Bhindi
9	Agricultural Research Station, Taliparamba	Paddy, Mango, Sapota Pepper
10	Agricultural Research Station, Ambalavayal/Central Horticultural Research Station, Ambalavayal	Paddy, Ginger, Sesa- mum, banana, Vanilla, Eucalyptus
11	Rice Research Station, Vythila	Paddy
12	Lemongrass Research Station, Odakkali	Lemongrass, Vettiver, Citronella
13	Vettiver Sub Station, Thiruvampaddy	Vettiver
14	Integrated seed Development Farm, Eruthanpatty	Groundnut, sesamum, caster
15	Oil seed Research Station, Kayamkulam	Seasamum
16	Banana & Pineapple Research, Station, Kannara/ Banana Research Station, Mannuthy/Banana Research Station, Trichur	Banana, Pineapple
17	District Agricultural farm, Neriya Mangalam	Pepper
18	Coconut Research Station, Neleswar	Coconut
19	Do Kumarakom	Coconut
20	Do Neyyattinkara	Coconut
21	Agricultural Research Station, Pilicode	Coconut
22	Cashew Research Station, Anakkayam	Cashew
23	Oil palm Research Station, Thodupuzha	Oil Palm, ginger, pepper
24	Cardamum Research Station, Pampadumpara	Cardamum
25	Pulses Research Station, Sasthamkotta	Redgram, cowpea Black gram
26	Tuber Research Station, Mannuthy	Tapioca, sweet potato
27	Tapioca Research Station, Thruvella	Tapioca
28.	Do Trivandrum	Tapioca

29	Sugarcane Research Farm, Thiruvella	Sugarcane
30	Do Travancore Sugar & Chemicals, Thiruvella	Sugarcane
31	Tobacco Research Station, Kanhangad	Tobacco
32	Pepper Research Station, Talparamba	Pepper
33	Coffee Demonstration Farm, Kalpetta	Coffee
34	Chellottee Estate, Krishna Estate and North Carolina Estate, Kalpetta	Coffee
35	Coffee Research Station, Malathottom	Coffee
36	Rubber Research Institute of India, Mundakkayam	Rubber
37	Do Malankara Estate	Rubber
38	Do Vaikundam Estate	Rubber
39	Do Udakadi, Kottayam	Rubber
40	Cultivators field trial in Ernakulam, Munkundapuram, Kanjirappally and	Rubber

APPENDIX 2

Yearly distribution of Agricultural Field Experiments Analysed

Sl No	Agricultural Research Station		59-60	60-61	61-62	62-63	63-64	64-65	65-66	66-67
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Rice Research Station	Kayamkulam	3	2	17	11	14	20	19	19
2	Do	Mannuthy	1	2	11	14	16	15	20	
3	Do	Kottarakara			1	1	10	7	9	11
4	Do	Montombu		2	2	3	1	8	6	19
5	Do	Pattambi	27	29	25	27	22	15	1	
6	Agronomic Research Station	Chalakudy						4	4	8
7	Do	Coyalmanam					3	4	5	8
8	Agricultural College	Vellayani		5	10	11		1		
9	Agricultural Research Station	Taliparamba	3	1						
10	Do	Ambalavayal	5	5	9	10	8	7		
11	Rice Research Station	Vythila				1				
12	Lemongrass Research Station	Odakkali	1	2	2	2	8	4	6	13
13	Vetiver sub station	Thuruvampaddy						2		
14	Integrated seed Development Farm	Eruthampathy						1	4	13
15	Oil seed Research Station	Kayamkulam	1					2	2	
16	Banana and Pine apple Research Station	Kannara								
	Banana & Pine apple Research Station	Mannuthy			1		8	9	3	
	Banana Research Station	Trichur								
17	District Agricultural Farm	Neriyamangalam								
18	Coconut Research Station	Neleswar								6
19	Do	Kumarakom	2	2	1	4	3	4	4	
20	Do	Neyyattinkara	1	1	1	1				
21	Agricultural Research Station	Pilcode			1	1	1	1		
22	Cashew Research Station	Anakkayam								

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APPENDIX 2 (Contd)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
23	Oil palm Research Station, Thodupuzha	4	8	4	6	6	7	6	
24	Cardamom Research Station, Pampadumpara								
25	Pulses Research Station, Sasthankotta						1	3	
26	Tuber Research Station, Mannuthy	2	3	3	2		1		
27	Tapioca Research Station Thiruvalla	1	1	1				1	
28	Do Trivandrum	1	1	1					
29	Sugarcane Research Farm Thiruvalla		3	1					
30	Do Travancore Sugar and Chemicals Thiruvella	1	1	1					
31	Tobacco Research Station, Kanhangad	2	3	3	2	1	2	2	
32	Pepper Research Station, Taliparamba			2		3	4		
33	Coffee Demonstration Farm, Kalpetta						2	2	
34	Chellotte estate, Krishnan Estate and North Carolina Estate Kalpetta		3	3					
35	Coffee Research Station, Malathottam		1	1					
36	Rubber Research Institute of India, Mundakkayam					1	1		
37	Do Malankara Estate					1	1		
38	Do Vaikundam Estate					1	1		
39	Do Udakkadi, Kottayam					1	1		
40	Cultivators Field Tribal in Ernakulam, Kanjurappally and Mukundapuram			3	3				
Total		55	75	104	99	108	125	97	97

APPENDIX 2 (Contd.)

37/913/MC

Sl. No	Agricultural Research Station		67-68	68-69	69-70	70-71	71-72	72-73	73-74	74-75	Total
(1)	(2)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1	Rice Research Station	Kayamkulam	17	23	26	32	34	27			264
2	Do.	Mannuthy			24	17	16	16	14	18	184
3	Do.	Kottarakkara	7	6	10	7	12	..			81
4	Do	Moncombu	14	27	12	7	.	.	.		101
5	Do.	Pattambi	37	51	26	.	.	.			260
6	Agronomic Research Station, Chalakudy		9	5				.			30
7	Do	Coyalmanam		.				.			20
8	Agricultural College, Vellayani						3				30
9	Agricultural Research Station, Taliparamba				.	.	.	.	.	.	4
10	Do.	Ambalavayal				.	.	.			44
11	Rice Research Station, Vythila				.	..	..	.	.		1
12	Lemongrass Research Station, Odakkali			14	19	18	25	39			153
13	Vetiver sub station, Thiruvampaddy				.	.	.	..	..		2
14	Integrated seed Development Farm, Eruthampathy			.	.	..	..	..	..		18
15	Oil seed Research Station, Kayamkulam				16	4	5	3			33
16	Banana and Pine apple Research Station, Kannara Banana & Pine apple Research Station, Mannuthy Banana Research Station, Trichur				15	17	4	.	.		57
17	District Agricultural Farm, Neriya Mangalam				.	.	6	4	4		14
18	Coconut Research Station, Neleswar		6			.					12
19	Do.	Kumarakom		8	6	3	.				37
20	Do.	Neyyattinkara		.			..	.			4
21	Agricultural Research Station, Pilicode			.	.	.	..	..	..		4
22	Cashew Research Station, Anakkayam		.		.	.	8	..	.		8

APPENDIX-2 (Contd)

(1)	(2)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
23	Oil palm Research Station, Thodupuzha	7		3	7	6	6			70
24	Cardamom Research Station, Pampadumpara			1	1					2
25	Pulses Research Station, Sasthankotta									4
26	Tuber Research Station, Mannuthy									11
27	Tapioca Research Station, Thiruvalla									4
28	Do Trivandrum									3
29	Sugarcane Research Farm, Thiruvalla									4
30	Do Travancore Sugar and Chemicals Thiruvalla									3
31	Tobacco Research Station, Kanhangad									15
32	Pepper Research Station, Taliparamba									9
33	Coffee Demonstration Farm, Kalpetta									4
34	Chellotte estate, Krishnan Estate and North Carolina Estate, Kalpetta									6
35	Coffee Research Station, Malathottom									2
36	Rubber Research Institute of India Mandakkayam									2
37	Do Malankara Estate									2
38	Do Vaikundam Estate									2
39	Do Udakadi, Kottayam									2
40	Cultivators Field Trial in Ernakulam, Kanjurappally and Mukundapuram									6
	Total	97	134	158	113	119	95	18	18	1512

APPENDIX 3

[No. of Agricultural field experiments analysed according to crops and types during 59-60 to 74-75

Sl No	Crops	Varietal Man- urial	Cultural	Varietal cum cultural	Manu- rial	Cultural cum manu- rial	Varietal cum seed rate	Weeds- control	Control of pests and diseases	Irriga- tional	Irriga- tional cum Manu- rial	Irriga- tional cum cultural	Irriga- tional cum cultural manu- rial	Manu- rial cum control of pests and diseases	Culti- vators field trial (Manu- rial)	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	Paddy	87	486	81	11	80	22	8	32	126	14	21	5	1	1	3	978
2	Lemon Grass	29	27	52	.	.	1	.	.	.	.	.	.	.	.	.	109
3	Vetiver	4	11	25	..	.	..	..	..	..	..	..	..	..	..	..	40
4	Citronella	6	..	..	..	.	..	..	..	.	.	.	.	.	.	.	6
5	Caster	1	..	..	.	.	..	..	.	..	..	..	..	..	..	..	1
6	Sesamum	16	12	8	.	.	..	..	..	..	..	..	..	..	..	..	36
7	Groundnut	6	2	6	..	.	..	.	.	.	.	..	.	.	.	.	14
8	Banana	..	18	5	.	.	6	..	.	.	4	.	.	.	.	.	39
9	Pineapple	..	13	2	.	.	10	.	.	.	.	.	.	.	.	.	25
10	Pepper	8	2	25	1	.	.	..	.	.	.	.	.	.	.	.	36
11	Coconut	..	47	10	.	.	.	.	.	.	.	.	.	.	.	.	57
12	Cashew	8	..	..	.	.	.	..	.	.	.	.	.	.	.	.	8
13	Ginger	2	18	19	..	.	4	..	..	11	1	.	.	.	.	.	55
14	Cardamom	..	..	2	..	.	.	..	.	.	.	.	.	.	.	.	2
15	Oil Palm	..	16	2	..	.	.	..	..	.	.	.	.	.	.	.	..

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
16	Red Gram	.		2	..					..				.			2
17	Cow pea			1	.					.	.		.				1
18	Bhundi					.		..		2	..		.	.	.	..	2
19	Sweet Potato	..	4	4				..	..	..	..	..	..	..	..	.	8
20	Tapioca						10	..	.	..	..		.				10
21	Sugarcane	..	7					.	..	..	..	..	..	.	..	..	7
22	Tobacco	.	9	3			3	.	..	..	..	..	..	..	..	..	15
23	Vanilla	.	2	9			.	..	..	..	..	..	4		.		15
24	Eucalyptus	.	2	3		.	..	..	..	..	..			.			5
25	Mango			1	..	.	..	..	..	..	..	..					1
26	Sapota	..	.	1	..	.	..	..	..	..	..	..		..			1
27	Coffee	.	10	2	.	.	..	..	..	..	..	..				.	12
28	Rubber	.	14		.	..	..	..	..	..	..	..					14
29	Mixed Cropping	.	.	.	..	..	1	..	..	..	..	..		..		..	1
Total		167	700	263	12	80	57	8	32	139	19	21	9	1	1	3	1512

APPENDIX-3 A.

No. of Agricultural field experiments obtained statistically significant results

	V	M	C	VC	MV	CM	VS	W	D	I	IM	IC	ICM	MD	cf(M)	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(15)	(17)	(18)
1	Paddy	59	196	24	8	61	12	4	9	50	5	8	3	.	1	3	443
2	Lemongrass	9	13	19	.	..	1		..	..	..	..		..	..	..	42
3	Vetiver	2	3	10	.	..	..	..	..	..	..	..	..	..	..	.	15
4	Citronella	3	.	.	..	..	..	..	..	..	..	..	.	..	.	..	3
5	Caster	1	..	.	..	..	..	..			.						1
6	Sesamum	7	12	5		..	..				2	..	.				26
7	Groundnut	6	1	3		..	.	..									10
8	Banana		10	5		..	3	..									18
9	Pine apple		12	2		.	..										14
10	Pepper	4	2	8	1	..	..	..	.								15
11	Coconut		12	5		.	..	..	..	..	.						17
12	Cashew	4				..	..		.								4
13	Ginger	2	9	14		..	5	.	.	1	1						32
14	Cardamum	2		2			..	..	.								4
15	Oil Palm			1				..									1
16	Red gram			1	.		..	..	..	..	.	.	..	.	.		1
17	Cowpea				.	..	..	.					
18	Bhindi					..	..	..		1							1

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
19	Sweet potato			4	.		.			.							4
20	Tapioca			.	.		10										10
21	Sugarcane		2	..													2
22	Tobacco		6	..	..	..	.3										9
23	Vanilla			4									2				6
24	Eucalyptus		2	3			..	.									5
25	Mango			1		.	..										1
26	Sapota			1		..		.									1
27	Coffee		3	1			.										4
28	Rubber		10			.	.										10
29	Mixed		1	.		..	.	..									1
	Total	99	294	113	9	61	34	4	9	52	8	8	5		1	3	700

V—Varietal
M—Manurial
C—Cultural
VC—Varietal-cum Cultural
MV—Manurial-cum-Varietal

CM—Cultural-cum-Manurial
VS—Varietal-cum-seedrate
W—Weedicidal
D—Control of Pests and disease
I—Irrigational
IM—Irrigational-cum-Manurial

IC—Irrigational-cum Cultural
ICM—Irrigational-cum-Cultural-cum-Manurial
MD—Manurial-cum-control of Pests & diseases
cf(M)—Cultivator's field trial (Manurial)

APPENDIX-4

Distribution of Agricultural field experiments according to Designs adopted in each Research Station during 1959-60 to 1974-75

Sl No	Agricultural Research Stations	DESIGN				Total
		RBD	Split plot	BIBD	Factorial	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Rice Research Station, Kayamkulam	234	27	1	2	264
2	Do, Mannuthy	159	19	.	6	184
3	Do, Kottarakara	58	16	.	7	81
4	Do, Moncompu	79	17	1	4	101
5	Do, Pattambi	208	33	.	19	260
6	Agronomic Research Station, Chalakudy	2	16	.	12	30
7	Do, Coyalmannam	2	10	.	8	20
8	Agricultural College, Vellayani	29	1	.	.	30
9	Agricultural Research Station, Taliparamba	4	.	..	.	4
10	Do, Ambalavayal	41	.	.	3	44
11	Rice Research Station, Vyttila	1	..	..	.	1
12	Lemon grass Research Station, Odakkali	144	8	.	1	153
13	Vetiver sub station, Thiruvampady	2	.	.	.	2
14	Integrated Seed Development Farm, Eruthampathy	16	2	..	..	18
15	Oil Seed Research Station, Kayamkulam	31	.	.	2	33
16	Babana and Pine apple Research Station, Kannara, Mannuthy	24	19	.	14	57
17	Banana Research Station, Trichur	.	.	.	.	.
17	District Agricultural Farm Neryyamagalam	14	.	.	.	14
18	Coconut Research Station, Nilaswar	.	12	.	.	12
19	Do, Kumarakom	37	.	.	.	37
20	Do, Neyyattunkara	4	.	.	..	4

(1)	(2)	(3)	(4)	(5)	(6)	(7)
21	Agricultural Research Station, Pilcode	,	4	.		4
22	Cashew Research Station, Anakkayam	8				8
23	Oil palm Research Station, Thodupuzha	58	5		7	70
24	Cardamom Research Station, Pampadumpara	2	.	.		2
25	Pulses Research Station, Sasthankotta	4	..	..	..	4
26	Tuber Research Station, Mannuthy	6	3		2	11
27	Tapioca Research Station, Thiruvalla	1	,	.	3	4
28	Do. Trivandrum	1	..	..	2	3
29	Sugar Research Farm, Thiruvalla	2	2	..	..	4
30	Do Travancore sugar and chemicals, Thiruvalla	2		.	..	3
31	Tobacco Research Station, Kanhangad	3	7	.	5	15
32	Pepper Research Station, Taliparamba	9	..	.	..	9
33	Coffee Demonstration Farm, Kalpetta	2	2	..	..	4
34	Chellote Estate, Krishna Estate and North Carolina Estate, Kalpetta		6		.	6
35	Coffee Research Station, Malathottam	.	2	..	..	2
36	Rubber Research Institute of India Mundakkayam	,	..	..	2	2
37	Do Malanakara Estate		.		2	2
38	Do Vaikundam Estate		.	.	2	2
39	Do Udakadi, Kottayam	.	.	.	2	2
40	Cultivators Field Trial in Ernakulam, Kanjirapally and Mukundapuram	6	.			6
Total		1184	221	2	105	1512

RBD—Randomised Block Design

BIBD—Balanced Incomplete Block Design.

APPENDIX 5

No. of Agricultural Field Experiments Analysed According to type from
1959-60 to 1974-75

Crop Paddy

Research Station	Vari- etal	Manu- rial	Cul- tural	Vari- etal cum cultural	Manu- rial cum vari- etal	Cul- tural cum Manu- rial	Vari- etal cum seed rate	Weeds- cidal	Control of pests and diseases	Irr- gational	Irr- gational cum manu- rial	Irr- gational cum cultural	Irr- gational cum control of pests and diseases	Manu- rial cum control of pests and diseases	Culti- vators field trial (manu- rial)	Total	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Rice Research Station, Kayamkulam	36	137	19	4	16	1		13	36								
2 Do Mannuthy	16	79	18	1	14	12	7	9	26					1	1		264
3 Do Kottarakkara	16	30	11		14	4	1	5							2		184
4 Do Mancompu	14	49	2	6	10	1		2	17								81
5 Do Pattambi	3	159	24		26	3		3	42								102
6 Agronomic Research Station Chalakudy			2	5						8	10	5					260
7 Agronomic Research Station Coyalmannam	2									6	11		1				30
8 Agricultural College, Vellayani			22			1			5								20
9 Agricultural Research Station Ambalavayal			6	1													28
10 Rice Research Station, Vythiri																	7
11 Agricultural Research Station, Taliparamba																	1
Total	87	486	81	11	80	22	8	32	126	14	21	5	1	1	3		978

TABLE 5 A

No. of Agricultural Field Experiments obtained statistically significant results

Research Station	Crop Paddy															
	Varetal	Manurial	Cultural	Varetal cum cultural	Manurial cum varetal	Cultural cum manurial	Varetal cum seed rate	Weedcrida.	Control of pests and diseases	Irrigational	Irrigational cum manurial	Irrigational cum cultural	Irrigational cum cultural cum manurial	Manurial cum control of pests and diseases	Cultivators field trial (manurial)	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Rice Research Station, Kayamkulam	22	52	11	3	10	1			18					1	1	119
2 Do Mannuthy	14	35		1	12	5	4	3	7						2	83
3 Do Kottarakkara	11	12	2		10	2		3								40
4 Do Mancompu	8	13		4	7			1	10							43
5 Do Pattambi	3	71	6		22	3		2	13							120
6 Agronomic Research Station Chalakudy			1	3						2	2	3				11
7 Do. Coyalmanam	1									3	6					10
8 Agricultural College, Vellayan		8				1			2							11
9 Agricultural Research Station, Ambalavayal		4	1													5
10 Rice Research Station Vythila			1													1
11 Agricultural Research Station Taliparamba																
Total	59	196	24	8	61	12	4	9	50	5	8	3		1	3	443

TABLE 5 1
No of Agricultural Field Experiments Analysed According to type

Research Station	<i>Crop Paddy</i>															
	<i>First Crop (Virippu) Autumn</i>															
	<i>Varetal</i>	<i>Manurial</i>	<i>Cultural</i>	<i>Varietal cum cultural</i>	<i>Manurial cum varietal</i>	<i>Cultural cum manurial</i>	<i>Varietal cum seed rate</i>	<i>Weedicidal</i>	<i>Control of pests and diseases</i>	<i>Irrigational</i>	<i>Irrigational cum manurial</i>	<i>Irrigational cum cultural</i>	<i>Irrigational cum cultural cum manurial</i>	<i>Manurial cum control of pests and diseases</i>	<i>Cultivators field trial (manurial)</i>	<i>Total</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Rice Research Station, Kayamkulam	21	68	12	1	7			10	22					1		142
2 Do Mannuthy	16	43	11		6	6	5	5	14							106
3 Do Kottarakkott	4	12	4		5	2	1	1								29
4 Do Moncompu																
5 Do Pattamba	2	94	14		15	2		3	23							159
6 Agronomic Research Station, Chalakudy			1	2						4	5	3				15
7 Do Coyalmannam	1									3	6		1			11
8. Agricultural College Vellayani		3							1							4
9. Agricultural Research Station, Ambalavayal		5	1													6
10 Rice Research Station, Vythila			1													1
11. Agricultural Research Station, Taliparamba		2														2
Total	44	228	45	1	33	10	6	19	60	7	11	3	1	1		469

TABLE 5 I A
No of Agricultural Field Experiments Obtained Statistically Significant Results

Research Station	Crop Paddy First Crop (Virippu)															
	Varied	Manurial	Cultural	Varied cum cultural	Manurial cum varietal	Cultural cum manurial	Varied cum seed rate	Weedicidal	Control of pests and diseases	Irrigational	Irrigational cum manurial	Irrigational cum cultural	Irrigational cum cultural cum manurial	Manurial cum control of pests and diseases	Cultivators field trial (manurial)	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Rice Research Station, Kayamkulam	13	25	9	1	4				10					1		63
2 Do Mannuthy	14	19			6	3	2	3	3							50
3 Do Kottarakkara	4	5	1		5											15
4 Do Moncompu																
5 Do Pattambi	2	42	5		13	2		2	8							74
6 Agronomic Research Station, Chalakudy			1	2						2	1	2				8
7 Do Coyalmannam										2	2					4
8 Agricultural college, Vellayani																3
9 Agricultural Research Station, Ambalavayal			3	1												4
10 Rice Research Station, Vythila				1												1
11 Agricultural Research Station Taliparamba																
Total	33	98	19	1	28	5	2	5	21	4	3	2		1		222

TABLE 5 2

No of Agricultural Field Experiments Analysed According to type

Crop Paddy
Second Crop (Mundakan—Winter)

Research Station	Varietal	Manurial	Cultural	Varietal cum cultural	Manurial cum varietal	Cultural cum manurial	Varietal cum seed rate	Weedcontrol	Control of pests and diseases	Irrigational	Irrigational cum manurial	Irrigational cum cultural	Irrigational cum cultural cum manurial	Manurial cum control of pests and diseases	Cultivator's field trial (Manurial)	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Rice Research Station Kayamkulam	15	69	7	3	9	1		3	14						1	122
2 Do Mannuthy		36	7	1	6	6	2	4	12							74
3 Do Kottarakkara	12	18	7		9	2		4								52
4 Do Mancompu	4	14		6	6	1			10							41
5 Do Pattambi	1	65	10		11	1			19							107
6 Agronomic Research Station, Chalakudy			1	3						4	5	2				15
7 Do Koyalmannam	1									3	5					9
8 Agricultural College, Vellayani		18				1			4							23
9 Agricultural Research Station, Ambalavayal		1														1
10 Rice Research Station, Vythila																
11 Agricultural Research Station, Taliparamba																
Total	93	222	34	10	41	12	2	11	59	7	10	2			1	444

TABLE 5.2 A

No. of Agricultural Field Experiments Obtained Statistically Significant results

Research Station	Varietal	Monural	Cultural	Varietal cum cultural	Manural cum varietal	Cultural cum manural	Varietal cum seed rate	Weedicidal	Control of pests and diseases	Irrigational	Irrigational cum manural	Irrigational cum cultural	Crop		Cultivators field trial (Manural)	Total
													Second crop	Paddy (Mundakan)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Rice Research Station, Kayamkulam	9	27	2	2	6	1			8						1	56
2 Do Mannuthy		16		1	4	2	2		4							29
3 Do Kottarakkra	7	7	1		5	2		3								25
4 Do Mancompu	1	3		4	5				4							17
5 Do Pattambi	1	29	1		9	1			5							46
6 Agronomic Research Station, Chalakudy			1								1	1				3
7 Do Coyalmannam	1									1	4					6
8 Agricultural College, Vellayani		4				1			2							7
9 Agricultural Research Station, Ambalavayal		1														1
10 Rice Research Station, Vythila																
11 Agricultural Research Station, Taliparamba																
Total	19	87	5	7	29	7	-2	3	23	1	5	1		1	190	

TABLE 5.3

No. of Agricultural Field Experiments Analysed According to type

Research Station	Varietal	Manurial	Cultural	Manurial cum varietal	Weedicidal	Control of pests and diseases	Crop Paddy	Total
							Thrd Crop (Punya-Summer)	
							Cultivators field trial (Manurial)	
1 Rice Research Station, Mannuthy				2			2	4
2 Do Mancompu	10	35	2	4	2	7		60
3 Agricultural College, Vellayani		1						1
Total	10	36	2	6	2	7	2	65

TABLE 5 3 A

No. of Agricultural Field Experiments Obtained Statistically Significant Results

Research Station	Varietal	Manurial	Cultural	Manurial cum varietal	Weedicidal	Control of pests and diseases	Crop Paddy	Total
							Thrd Crop (Punya)	
							Cultivator's field trial (Manurial)	
Rice Research Station, Mannuthy				2			2	4
Do Mancompu	7	10		2	1	6		26
Agricultural College, Vellayani		1						1
Total	7	11		4	1	6	2	31

APPENDIX 6

No. of Agricultural Field Experiments analysed on straw

Research Station	No of Experiments analysed						Total
	Varietal	Manurial	Cultural	Manurial cum varietal	Weed- cidal	Control of pests and diseases	
1 R R Station, Kayamkulam	8	26		4	5		43
2 Do Kottarakara				2			2
3 Do Mancōmpu	2	12	1	2		3	21
4 Do Pattambi		15	1	3	1		20
Total	10	53	2	11	7	3	86

APPENDIX 7 1

RICE RESEARCH STATION, KAYAMKULAM

Details of Fertiliser trials

Category of experiment	Am of experiment	T No	Details of Treatment
A To find out the effect of continuous application of Nitrogen both as organic and inorganic as well as phosphuric acid and potash on the soil fertility and yield of rice	1	40 Kg	N/Hec. as cattle manure
	2	do	as Amo. sul
	3	do	+30 kg P ₂ O ₅
	4	do	+30 kg K ₂ O
	5	40 kg	P ₂ O ₅ +30 kg K ₂ O
	6	40 kg	N+30 kg P ₂ O ₅ +30 kg. K ₂ O
	7	40 kg	N+10 kg cattle manure + 30 kg P ₂ O ₅ + 30 kg K ₂ O

<i>Category of Experiment</i>	<i>Aim of experiment</i>	<i>T No</i>	<i>Details of treatment</i>				
			<i>Basal</i>	<i>Tillering</i>	<i>PI Stage</i>	<i>Booting</i>	<i>Heading</i>
B.	To find out the effect of split application of Nitrogen in the yield of rice	1	75%		25%		
		2	75%		12 5%	12 5%	.
		3	75%		12 5%		12 5%
		4.	75%			12 5%	12 5%
		5.	..	50%	25%	25%	.
		6.	..	50%		25%	25%
		7.	50%	..	25%	25%	.
		8.	50%	..	.	25%	25%
		9.	..	33%	33%	34%	.
		10.	..	33%	.	33%	34%
		11	33%		33%	34%	
		12.	20%	20%	20%	20%	20%

C.	To find out the effect of fractional application of lime on the yield of rice	1.	No lime
		2	100 % as basal
		3	50% basal + 50% at tillering
		4	33% basal+33% at tillery+34% at PI stage
		5.	50% basal+50% in 4 equal instalments
		6	25% basal+75% in 4 equal instalments

		<i>Basal</i>	<i>Tillering</i>	<i>PI Stage</i>	<i>Booting</i>	<i>Heading</i>	
			<i>(in percentages)</i>				
D	To find out the effect of fractional applications of Nitrogen in the growth and yield of rice	1	100				.
		2	..	100		.	
		3	..	..	100		..
		4.	50	50	..	..
		5	50	..	50	..	
		6.	50	..	..	50	..
		7	50	..	..	..	50
		8.	50	25	25	..	..
		9.	50	.	25	25	
		10.	50	..	..	25	25
		11	..	50	50	..	.
		12.	..	50	25	25	..
		13	..	50	25	..	25
		14.	..	..	50	25	25
		15.	20	20	20	20	20
		16	25	25	25	25	

T No :- Treatment No.

37/913/MC

APPENDIX 72.

RESEARCH STATION, MANNUTHY

Details of Fertiliser trials

Category of experiment	Aim of experiment	T No.	Details of Treatments				
A	To study the effects of continuous application of Nitrogen both organic and inorganic with and without phospheric and potash	1	N 80 kg /hect as Amo sul				
		2	N 80 kg /hect as Green leaf				
		3	N 80 kg /hect as Amo sul & P ₂ O ₅ , 50 kg /ha as sup ph.				
		4	N 80 kg /hect as Amo sul and K ₂ O, 50 kg/hect				
		5	P ₂ O ₅ and K ₂ O at 50 kg /hect. as sup phosphate and Mur p				
		6	N 80 kg /hect as Amo sul and P ₂ O ₅ and K ₂ O @ 50 kg as sup phos Mur p				
		7	N 80 kg /hect 1/2 as amo sul and 1/2 as green leaf and P ₂ O ₅ and K ₂ O @ 50 kg/hect as sup phos and Mur p				
B	To study the effect of split application of Nitrogen on the paddy field		<i>Planting</i>	<i>Tullering</i>	<i>PI. stage</i>	<i>Booting</i>	<i>Heading</i>
		1	75		25		
		2	75		12 5	12 5	
		3	75		12 5		12 5
		4	75			12 5	12 5
		5		50	25	25	
		6		50		25	25
		7	50		25	25	
		8	50			25	25
		9		33	33	33	
		10		33		33	33
		11	33		33	33	
12	20	20	20	20	20		
B 1	To study the effect of split application of Nitrogen on the paddy field	1	100				
		2		100			
		3			100		
		4	50	50			
		5	50		50		
		6	50			50	
		7	50				50
		8	50	25	25		
		9	50	..	25	25	
		10	50	..		25	25
		11		50	50		
		12		50	25	25	
		13		50	25		25
		14			50	25	25
		15	20	20	20	20	20
		16	25	25	25	25	..

APPENDIX 7.2 (Contd.)

Category of experiment	Aim of expenditure	T No	Details of Treatments
C	To find out the effect of fractional application of potash on paddy crops	1	No potash
		2	100 % as Basal
		3	67% as Basal + 33% at p 1 stage
		4	50% as Basal + 50% at p 1 stage
		5	50% as Basal + 25% at tillering +25% at P 1 stage
D	To find out the optimum time of application of Amo sulphate to transplanted paddy crop		(split application of 44.8 kg/ha of Nas A/S)
		1	Mo—control
		2	M1—Full dose as basal dressing
		3	M2— $\frac{1}{2}$ as Basal dressing $\frac{1}{2}$ one month before flowering
		4	M3— $\frac{2}{3}$ as Basal dressing $\frac{1}{3}$ one month before flowering
		5	M4— $\frac{1}{3}$ as Basal dressing and $\frac{2}{3}$ one month before planting
6	M5—Full dose as top dressing		
E	To study the effect of different levels of N, P, K alone and in Combination		3 Combinations
		1	3 levels of N, as A/S N1=16.8, N2=33.6, N3=50.4 kg/Ha
		2	3 levels of P ₂ O ₅ as super phos P1=16.8, P2=33.6, P3=50.4 kg/Ha
3	3 levels of K ₂ O as Muriat of Potash K1=16.8, K2=33.6, K3=50.4 kg/Ha $\frac{1}{2}$ dose of N and Full dose of P ₂ O ₅ and K ₂ O applied as basal dressing Rest $\frac{1}{2}$ dose of N was applied as top dressing before flowering		
F	To study the effect of different levels of NPK on paddy		7 Manurial Treatments
		1	T1—40 kg N/ha as A/S
		2	T2—40 kg N/ha as G L
		3	T3—T1+30 kg P ₂ O ₅ /ha as sup phos
		4	T4—T1+30 kg K ₂ O/hect as Mur p
		5	T5—30 kg P ₂ O ₅ /ha as sup phos +30 kg K ₂ O/he as Mur p
		6	T6—T1+T5
7	T7—20 kg N/ha as A/S +30 kg N/ha as GL+T5		
G	To study the effect of application of Nitrophosphate complex fertilizers on paddy	1	3 types of phosphate p1—sup phos, P ₂ Nitro-phos produced by ODDA process and P3—Nitro-phos produced by PECP
		2	3 levels of fertilizers L1—13.5 kg/Ha of N+11.8 kg/Ha of P ₂ O ₅ L2—26.9 kg/ha of N+23.8 kg of P ₂ O ₅ L3—53.8 kg/Ha of N—47.1 kg/Ha P ₂ O ₅
		3	Three methods of application M1—Broadcast M2—6.4 cm below surface M3—Pellet application N—applied as A/S when ever super is used Half the quality of N fertilizers applied as top dressing prior to flowering All other manures applied as basal dressing

APPENDIX 7 3

RICE RESEARCH STATION, MONCOMPU

Details of fertiliser trials

<i>Category of experiment</i>	<i>Aim of Experiment</i>	<i>Details of Treatment</i>
(1)	(2)	(3)
A	To find out whether phosphotic fertilizers such as fused Magnisum phosphate, Deflourite rock phosphate, multi phosphate where phosphate is citric soluble are as good as or superior to super phosphate containing p205 in water soluble form	1 Control
		2 Single super @ 30 lbs P ₂ O ₅ /acre
		3 Single super @ 60 lbs P ₂ O ₅ /acre
		4 Rock phosphate @ 30 lbs P ₂ O ₅ /acre.
		5 do 60 do
		6 Fused Mag phosphate @ 30 lbs/acre
		7 do @ 60 lbs/acre
		8 DafLOURinated phosphate @ 30 lbs/acre
		9 do @ 60 lbs/acre
		10 Multiphosphate @ 30 lbs/acre
		11 do @ 60 lbs/acre
		12 Hyper phosphate @ 30 lbs/acre
		13 do @ 60 lbs/acre
		14 Nitrophosphate @ 30 lbs/acre
		15 do @ 60 lbs/acre
		16 No phosphate
		17 No phosphate
		18 Basic slag @ 30 lbs/acre
		19 Basic slag @ 60 lbs/acre
		20 Control (No phosphate)
		21 Control (No phosphate)
B	To find out the effect of N, P ₂ O ₅ and lime alone and in their combinations and interactions	1 Levels of Nas A/S N1=33 6 N2=50 4 kg/hect
		2 Levels of P ₂ O ₅ as super P=44 8 kg/Ha P2=67 2 kg/hect
		3 Levels of lime Lo—0, L1=336, L2=672 kg/Ha
		1 N1 p1 Lo
		2 N1 P1 L1
		3 N1 P1 L2
		4 N1 P2 L0
		5 N1 P2 L1
		6 N1 P2 L2
		7 N2 P1 L0
		8 N2 P1 L1
		9 N2 P1 L2
		10 N2 P2 L0
11 N2 P2 L1		
12 N2 P2 L2		
C	To study the nutritional requirements of IR8 under Kuttanad conditions	4 levels of N
		N1—Nitrogen 60 kg/Ha
		N2 do 80 kg/Ha
		N3 do 100 kg/Ha.
		N4 do 120 kg/Ha

(1)	(2)	(3)
		<i>3 levels of P₂O₅</i>
		P1—P ₂ O ₅ 40 kg/Ha
		P2 do 60 kg/Ha
		P3 do. 80 kg/Ha
		<i>Treatments</i>
		1 N1 P1
		2 N1 P2
		3 N1 P3
		4 N2 P1
		5 N2 P2
		6 N2 P3
		7 N3 P1
		8 N3 P2
		9 N3 P3
		10 N4 P1
		11 N4 P2
		12 N4 P3
D	To study the effect of lime and different source of P on paddy	<p><i>Main plot treatments</i> 2 levels of lime LO=O and L=1121 kg/ha of slaked lime</p> <p><i>Sub plots treatments</i> 5 sources of P₂O₅ at 448 kg/Ha SO=control (no P₂O₅) SI—super phos S2=Hyperphos S3—Rock phos S4—BM P₂O₅ and lime applied as basal dressing before planting</p>

APPENDIX 74

AGRICULTURAL RESEARCH STATION, PATTAMBI

Details of Fertiliser trials

Category	Aim of Experiment	T No	Details of Treatment
(1)	(2)	(3)	(4)
A	To study the effect of continuous application of green leaf and Ammonium sulphate and their combination	1	G L. @ 5600 kg/Ha to give 30 kg of N.
		2	G L @ 1200 kg/Ha to give 60 kg of N.
		3	G L @ 5000 kg/Ha + 168 kg of N-as. Amo Sul
		4	Amo sul to supply 366 kg of N
		5	Amo sul to supply 732 kg of N
A1	To study the effect of continuous application of Green leaves, cattle manure and Amo Sul individually	1	CM @ 8000 lbs/acre
		2	GL @ 8000 lbs/acre
		3	CM @ 4000 lbs/acre + GL—@ 4000 lbs/acre
		4	Amo sul to supply 40 lbs of N/acre
		5	CM @ 4000 lbs/acre and NPK to supply 20 lbs/acre each in the form of Amo Sul super phos. and Mur P.

APPENDIX 74 (Contd.)

(1)	(3)	(3)	(4)
		6	G L @ 4000 lbs/acre and NPK to supply 20 lbs/acre each in the form of Amo sul super Phos and Mur P
		7	CM+GL each @ 2000 lbs/acre and NPK to supply 20 lbs/acre each as Amo sul sup phos and Mur P
		8	Amo sul to supply 40 lbs N and super to supply 20 lbs of P_2O_5 /acre
			<i>Note</i> Amo sul in treatments applied as top dressing one month before flowering
			44 8 kg/ha of Nitrogen
B	To study the effect of different sources and time of application of Nitrogen on paddy	1	T1—Before planting
		2	T2—2 weeks after planting
		3	T3—4 weeks after planting
		4	T4— $\frac{1}{2}$ dose as Basal dressing + $\frac{1}{2}$ dose two weeks after planting
		5	T5— $\frac{1}{2}$ dose as Basal— $\frac{1}{2}$ dose 4 weeks after planting
		6	T6— $\frac{1}{2}$ dose two weeks after planting + $\frac{1}{2}$ dose four weeks after planting
C	To find out the best combination of different levels of NP and K for paddy	1	All combinations of (1) (2) and (3) 3 levels of N1 as A/S N1=16 8, N2=33 6 N3=50 4 kg/Ha
		2	3 levels of P_2O_5 as super P1=16 8, P2=33 6 P3=50 4 kg/Ha
		3	3 levels of K_2O as Mur P K1=16 8, K2=33 6, K3=50 4 kg/Ha $\frac{1}{2}$ of N, full dose of P_2O_5 and K20 as basal dressing $\frac{1}{2}$ dose of Nitrogen one month before flowering
D	To study the effect of Nitrophosphate complex fertilizers produced by different processes and applied to previous paddy crop on the succeeding paddy crop	1	All combinations of (1) (2) and (3) 3 types of fertilizers P1—single super p2—Nitrophos produced by OD DA (20-20-20) and P3—Nitrophos produced by PEC (16-14-0) 3 levels of fertilizer L1—13 5 Kg/Ha of [N+11 8 kg/ha of P_2O_5 L2—26 9kg/ha of N+23 5kg/ha of P_2O_5 L3—53 8 kg/Ha of N+47 1 kg/Ha P_2O_5 (3) 3 Methods of application M1—Broadcast M2—6 cm below seed at planting M3—Pellet application 10 days after planting The sources of N is A/S when applied with P

APPENDIX 74 (Contd.)

(1)	(2)	(3)	(4)							
E	To study the response of new varieties to N and select the best variety of seed for double crop-wet land	6 Varieties and 3 levels of nitrogen								
		<i>Varieties</i>								
		V1—IR8	}	N1—80 kg /Ha.						
		V2—IR 262		N2—100 kg /Ha.						
		V3—Jaya		N3—120 kg /Ha.						
		V4—Cul 28								
		V5—Padma								
		V6—Ptb 9								
		<i>Treatments</i>								
		1	V1 N1	7	V3 N1	13	V5 N1			
		2	V1 N2	8	V3 N2	14	V5 N2			
		3	V1 N3	9	V3 N3	15	V5 N3			
4	V2 N1	10	V4 N1	16	V6 N1					
5	V2 N2	11	V4 N2	17	V6 N2					
6	V2 N3	12	V4 N3	18	V6 N3					
F	To study whether phosphate manuring of seedlings can serve phosphate application in the main field	P_2O_5 given in the nursery kg /Ha	Nitrogen level given while Planting in the main field (kg /Ha)							
		0	0	30	60	90	120			
		30	(1)	(2)	(3)	(4)	(5)			
		60	(6)	(7)	(8)	(9)	(10)			
		90	(11)	(12)	(13)	(14)	(15)			
			(16)	(17)	(18)	(19)	(20)			
G	To compare the effect of soil and foliar application of Nitrogen to rice	Nitrogen will be applied in the form of Urea								
			Basal	Top dressing			Foliar application			
				1	2	3	1	2	3	4
		1	30	10	10	10				
		2	30		10	10	10			..
		3	30			10	10			
		4	30				10	10	10	.
		5					10			
		6					10	10		
		7					10	10	10	
8					10	10	10	10		
9		No Nitrogen								
H	To determine the most appropriate time of application of Nitrogen to IR8	At plant- ing	At initial til- lering	At 50% tillering	Maximum tillering	At P1 stage				
		1.	20%	20%	20%	20%	20%			
		2.	100%							
		3	50%				50%			
		4.					100%			
		5		25%	25%	25%	25%			
		6	34%		33%		33%			

(1)	(2)	(3)	(4)		
I	To study the efficient use of different levels of Nitrogen at different times of application	<i>Total N kg /Ha</i>	<i>Basal</i>	<i>At tillering</i>	<i>At A1 stage</i>
		1.	.		
		2	60	60	
		3	80	80	
		4	80	60	20
		5	80	60	20
		6	80	40	20
		7	100	100	
		8	100	80	20
		9	100	80	20
		10	100	60	20

	<i>Do</i>		<i>Basal</i>	<i>Tillering</i>	<i>P 1 stage</i>
I ₁	Do.	1			
		2	40	20	20
		3	100		
		4	75	25	
		5	75		25
		6	50	50	
		7	50		50
		8	50	25	25
		9	25	75	
		10	25	50	25
		11		100	
		12		75	25
		13		50	50
		14.		..	..

			<i>Basal</i>	<i>Tillering</i>	<i>P 1 stage</i>	<i>Booting</i>	<i>Heading</i>
I ₂	Do.	1	75			25	
		2	75			12 5	
		3	75			12 5	
		4	75			12 5	12 5
		5		50	25	25	
		6		50		25	25
		7	50		25	25	
		8.	50			25	25
		9	..	33	33	34	34
		10	..	33		33	34
		11.	33		33	34	..
		12	20	20	20	20	20



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