

C O N T E N T S

	<u>Pages</u>
I. PERSONNEL	
II. INTRODUCTION	1 to 2
III. EXPERIMENTAL	
a) Model Agronomic Research Station, Karamana	3 to 9
b) E.C.F. Districts (Kottayam and Kozhikode)	9 to 12
IV. RESULTS AND DISCUSSION	
a) Model Agronomic Research Station, Karamana	13 to 22
b) E.C.F. Districts (Kottayam and Kozhikode)	23 to 55
V. SALIENT RESULTS	56 to 57
VI. ANNEXURE	

PERSONNEL

I. STAFF AT HEADQUARTERS UNIT

Officer in charge

1. Dr. V.T. Alexander, Associate Professor
1-4-78 to 7-7-1978.
2. Sri. T.F. Kuriakose, Associate Professor
8-7-78 to 31-3-'79.

Statistician

1. Sri. K. Mukundan, Asst. Professor
1-4-78 to 29-8-78.
2. Sri. K. Janardhanan Pillai, Asst. Professor
30-8-78 to 31-3-'79.

II. MODEL AGRONOMIC RESEARCH STATION

Agronomist

1. Sri. V. Ramachandran Nair, Associate Professor
1-4-78 to 31-3-1979.

III. EXPERIMENT ON CULTIVATORS' FIELD UNIT, KOZHIKODE DISTRICT

Assistant Agronomist

1. Sri.M.R. Chidananda Pillai, Asst. Professor
1-4-78 to 19-4-'78.
2. Sri. R.R. Nair, Assistant Professor
20-4-78 to 16-6-'78.
3. Sri. Madhusoodanan Nair, Asst. Professor
17-6-78 to 31-3-'79.

IV. EXPERIMENT ON CULTIVATORS' FIELD UNIT, KOTTAYAM DISTRICT

1. Sri. P.J. Ittyavirah, Asst. Professor
1-4-78 to 11-6-'78.
2. Sri. K. Sankara Panicker, Asst. Professor
12-6-78 to 31-3-'79.

INTRODUCTION

Simple fertilizer trials under the "Fertilizer use and soil fertility project" sponsored by the Indian Council of Agricultural Research have been in existence at the Model Agronomic Research Station, Karamana, since 1955. Consequent to the introduction of high yielding varieties and newer materials and the changed outlook on agricultural strategy, the scope and the content of the project have been widened. This has resulted in the formation of the All India Coordinated Agronomic Research Project which is being implemented in the State from 1968 onwards. Under the new set up replicated experiments and newer materials are tried in the Agronomic Research Station and the simple fertilizer trials are laid out in the selected cultivators' fields. The simple fertilizer trials are conducted in each district for three years, and thereafter the work is shifted to another district. At present there is one Agronomic Research Station at Karamana and there are two Experiments on Cultivators' Fields Units working at Kottayam and Kozhikode districts which are situated in the two different agro-climatic zones of the State.

The present report gives a brief account of the research activities taken up in the year 1978-79 under the All India Coordinated Agronomic Research Project. The report is presented in three parts.

In the first part the technical programme of the Agronomic Research Station and the two Experiments on Cultivators' Fields Units are given. The technical programme of the Agronomic Research Station is so oriented as to get information on the economics of different crop sequences, long range effect of continuous cropping, performance of pre release varieties, direct, residual and cumulative effects of Farm yard manure, Phosphorus and potash and efficiency of organic and slow release nitrogenous fertilizers. The technical programme of E.C.F. is formulated to evaluate the response of high yielding

rice varieties to nitrogen, phosphorus, potash and Lime and to evaluate the performance of pre release varieties of rice with a view to formulate fertilizer recommendations and to suggest suitable varieties for different agro-climatic regions of the State.

Part two of the report is concerned with the results of the experiments conducted at the Agronomic Research Station, Karamana and in the E.C.F. units at Kozhikode and Kottayam districts and the discussion thereon.

The summary and the important conclusions drawn from the results of experiments conducted at M.A.E. and E.C.F., forms part three of the report.

PART -I

EXPERIMENTAL

MODEL AGRONOMIC EXPERIMENTS AT THE AGRONOMIC RESEARCH
STATION, KARAMANA.

The technical programme of each of the experiments conducted at the Model Agronomic Research Station, Karamana during the period under report are furnished below.

I. Experiment No.1(a)

Title : Multiple cropping under irrigated conditions.

Objective : This experiment is designed to study the economics of high intensity crop sequences and their effect on soil productivity when grown continuously over years.

Treatments - six

1. Rice - Rice - Green manure (Daincha)
2. Rice - Rice - Green gram
3. Rice - Rice - Groundnut
4. Rice - Rice - Sesamum
5. Rice - Rice - Cowpea
6. Rice - Rice - Maize

Design : R.B.D.

Replications : Four

Plot size : 9 M x 6 M

Spacing: Paddy - 15 cm x 15 cm.

Green gram Ø Sown using the recommended
Sesamum Ø seed rate.

Cowpea : 30 cm x 15 cm

Maize : 60 cm x 30 cm

The experiment was started during the kharif season 1978-79.

II. Experiment No.1(d)

Title : Studies on Intercropping.

Objective : The objective of this experiment is to screen different short duration crops like groundnut, cowpea and maize for their suitability to be grown as intercrops along with a short duration Tapioca (var. H.165) in the summer rice fallows.

Treatments : Four

1. T₁- Tapioca alone.
2. T₂- Tapioca + Groundnut (TMV-2)
3. T₃- Tapioca + Cowpea (C.152).
4. T₄- Tapioca + Maize (Ganga 5)

Spacing : Tapioca - 90 cms apart (both ways)

Groundnut \emptyset Two rows in between two rows of
Cowpea \emptyset Tapioca at a spacing of 15 cms within
the row.

Maize - One row of maize in between two rows
of Tapioca at a spacing of 45 cms.

Design - Randomised block

Replications - Six

Plot size - 9.9 M x 9.9 M.

This experiment was first laid out in 1978 summer season. Altogether 5 irrigations were given. Main crop of tapioca was planted on 21-2-1979 and intercrops were dibbled on 23-2-1979.

III. Experiment No.1(e)

Title : Studies on mixed cropping.

Objectives : The intention of laying out this experiment is to study the overall production and economics of mixing seeds of rice varieties of 1st and 2nd crop seasons together and sowing in the 1st crop season, which practice is being followed locally.

Treatments : Eight.

1. Medium duration high yielding varieties for both Kharif and rabi seasons.
2. Local varieties of paddy for both Kharif and rabi seasons.
3. Medium duration high yielding variety in Kharif season and a local photosensitive variety in rabi season.
4. Local photosensitive variety in kharif season and a high yielding variety in rabi season.
5. Mixed sowing in kharif season of medium duration high yielding variety and a photosensitive local variety of rabi season in the ratio of 2:1.
6. Mixed sowing in Kharif season of medium duration high yielding variety and a photosensitive local variety of rabi season in the ratio of 3:1.

- 7. Mixed sowing in Kharif season of two photosensitive local varieties of Kharif and rabi seasons in the ratio of 2:1.
- 8. Mixed sowing in Kharif season of two photosensitive varieties of Kharif and rabi seasons in the ratio of 3:1.

Manuring is as per state recommendations.

Design : Randomised block design.
 Replications : Four
 Plot size : 6 M x 5 M.
 Spacing : 20 cm x 10 cm
 Variety : High yielding variety - Jaya.
 Photosensitive variety of
 Kharif season - PTB-9.
 Photosensitive variety
 of rabi season - Kottarakkara-1.

IV. Experiment No.2

Title : Manurial requirements of a fixed crop rotation.
 Objective : To study the direct, residual and cumulative effects of P, K and Farm Yard Manure on a fixed single year two crop rotation with high yielding varieties.

Treatments

Main plots : All combinations of
 0, 30 and 60 kg P₂O₅/ha
 0 and 30 kg K₂O/ha.
 0 and 15000 kg F.Y.M./ha.
 120 kg N to all the plots.

Sub plots : M₁ - manuring every season
 M₂ - manuring in alternate season.
 starting from first season.
 M₃ - manuring in alternate season
 starting from second season.

Design : Split plot design with combination of P, K and F.Y.M. in main plots and phases of manuring in sub plots.

Replications : Four
 Plot size : Gross - 9 M x 3 M.
 Net - 8.40 M x 2.40 M
 Spacing : 15 cm x 15 cm
 Variety : Jaya.

V. Experiment No.3

- Title : Long range effect of continuous cropping and manuring.
- Objectives : To study the long range effect of a crop rotation with high yielding varieties at graded fertilizer levels on the yield stability and soil fertility.
- Treatments : All the 18 combinations of (1), (2) and (3) + one control plot in each Block.
1. 3 levels of N : N_1 - 40 kg/ha.
 N_2 - 80 kg/ha
 N_3 - 120 kg/ha
 2. 3 levels of P_2O_5 P_0 - No application of P_2O_5
 P_1 - 40 kg/ha
 P_2 - 80 kg/ha.
 3. 2 levels of K_2O K_0 - No application of K_2O +
 K_1 - 40 kg/ha.
(one control plot ($N_0 P_0 K_0$) in each block.
- Design : $3^2 \times 2$ factorial partially confounded design with one control plot in each block.
- Replications : Four
- Plot size : Gross - 10 M x 3 M
Net - 9.2 M x 2.60 M.
- Spacing : 20 cm x 10 cm
- Variety : Jaya

VI. Experiment No.4

- Title : Agronomic evaluation of new promising pre release varieties of cereals (Rice)
- Objective : To study the performance of pre release varieties in relation to date of sowing as well as nitrogen application.

Treatments

- 3 dates of sowing : D₁ - sown on normal date (last week of June and September)
 D₂ - Sown 15 days after normal date (middle of July and October)
 D₃ - Sown 30 days after normal date (end of July and October)
- 3 varieties : V₀ - Locally popular variety (Thriveni)
 V₁ - Pre-release (Culture 1907).
 V₂ - Pre-release (I.R. 36).
- 4 levels of Nitrogen : N₀ - No nitrogen
 N₁ - 40 kg N/ha.
 N₂ - 80 kg N/ha.
 N₃ - 120 kg N/ha.
- Design : Split-split plot.
 Dates in main plots, levels in sub plots and varieties in sub - sub plots.
- Replication : Four
- Plot size : Gross - 6 M x 5 M
 Net - 5.20 M x 4.60 M.
- Spacing : 20 cm x 10 cm

VII. Experiment No.8

- Title : Fertilizer economy through organic manures.
- Objectives : To study the possibility of economising nitrogenous fertilizers through organic manures in crop sequence.

TreatmentsKharif season

- T₁ - Control
 T₂ - F.Y.M. at 12 tons/ha.
 T₃ - No FYM + N₃₀ P₁₅ K₁₅
 T₄ - FYM at 12 tons/ha + N₃₀ P₁₅ K₁₅
 T₅ - No FYM + N₉₀ P₄₅ K₄₅
 T₆ - FYM @ 12 tonnes + N₆₀ P₃₀ K₃₀
 T₇ - No FYM + N₉₀ P₄₅ K₄₅

Rabi Season

The treatments of the Kharif seasons will be repeated

Summer season

The residual effect will be studied by taking a cowpea crop.

T₈ - FYM at 12 tons/ha + N₉₀P₄₅ K₄₅

T₉ - No FYM + N₁₂₀ P₆₀ K₆₀

T₁₀ - FYM at 12 tons/ha + N₁₂₀ P₆₀ K₆₀

Design : Randomised Block Design
 Replications : Four
 Plot size : Gross 10 x 3 M.
 Spacing : Kharif - 20 x 15 cm
 Rabi - 20 x 10 cm
 Summer - 30 x 15 cm
 Cowpea
 Variety : Jaya

VIII. Experiment No.9.a.

Title : Slow release and different grades of urea briquettes on rice.
 Objectives : To study the relative efficiency of slow release N fertilizer for rice and its residual effect on succeeding crop.

Treatments

A - Main plot treatment - 7 Nos.

- S₁ - Control
- S₂ - Urea at planting
- S₃ - Urea split application
- S₄ - Urea briquette 1.0 g size
- S₅ - Urea briquette 1.9 g size
- S₆ - Urea briquette 2.9 g size
- S₇ - Sulphur coated urea.

B - Sub plot treatments

- d₁ - 40 kg N/ha
- d₂ - 80 kg N/ha.
- d₃ - 120 kg N/ha.

(P and K shall be applied basal as per soil test or recommended level in all treatments)

Design : Split plot design with source along with control (no nitrogen) in main plots and doses in sub plots.

- Replication : Three
- Gross plot size : 30 sq.m.
For net plot size about half meter border should be left all around the plot.
- Spacing : 20 x 15 cm (Kharif)
- Variety : Jaya.
- Time and method of application of nitrogen ; Nitrogen will not be applied in control plots.
2. Split application of urea will be done as per normal practice ie. half at planting and half dressed at panicle initiation stage.
 3. All slow release nitrogen fertilizer should be applied in one dose at planting.

TECHNICAL PROGRAMME OF EXPERIMENTS ON CULTIVATORS' FIELD, 1977-78

Type A : Fertilizer requirements of high yielding hybrid varieties of cereals under irrigated/assured water supply conditions.

<u>No. of plots</u>	<u>Sl.No. of treatments</u>	<u>Treatment notations</u>
12	T ₁	N ₀ P ₀ K ₀
	T ₂	N ₄₀ P ₀ K ₀
	T ₃	N ₈₀ P ₀ K ₀
	T ₄	N ₁₂₀ P ₀ K ₀
	T ₅	N ₄₀ P ₂₀ K ₀
	T ₆	N ₈₀ P ₄₀ K ₀
	T ₇	N ₁₂₀ P ₆₀ K ₀
	T ₈	N ₄₀ P ₂₀ K ₂₀
	T ₉	N ₈₀ P ₄₀ K ₄₀
	T ₁₀	N ₁₂₀ P ₆₀ K ₆₀
	T ₁₁	N ₁₂₀ P ₆₀ K ₄₀
	T ₁₂	N ₁₂₀ P ₆₀ K ₄₀ + Lime 500 kg/ha.

Note (i) This experiment will be conducted on fresh sites separately selected during kharif and rabi seasons. All the 12 treatments will be randomised during Kharif as well as in rabi seasons.

(ii) Levels of fertilizers

N_0 - No nitrogen, N_{40} - 40 kg N/ha, N_{80} - 80 kg N/ha.

N_{120} - 120 kg N/ha.

P_0 - No phosphorus, P_{20} - 20 kg P_2O_5 /ha,

P_{40} - 40 kg P_2O_5 /ha, P_{60} - 60 kg P_2O_5 /ha.

K_0 - No potassium, K_{20} - 20 kg K_2O /ha,

K_{40} - 40 kg K_2O /ha, K_{60} - 60 kg K_2O /ha.

Lime - @ 500 kg/ha.

Type B1 - Comparative performance of pre-release and standard crop varieties of cereals and their nitrogen requirements under irrigated assured water supply conditions.

<u>No. of plots</u>	<u>Sl.No. of treatments</u>	<u>Treatment notations</u>
	T ₁	V ₁ N ₀
	T ₂	V ₁ N ₄₀
	T ₃	V ₁ N ₈₀
	T ₄	V ₁ N ₁₂₀
	T ₅	V ₂ N ₀
	T ₆	V ₂ N ₄₀
	T ₇	V ₂ N ₈₀
	T ₈	V ₂ N ₁₂₀
	T ₉	V ₃ N ₀
	T ₁₀	V ₃ N ₄₀
	T ₁₁	V ₃ N ₈₀
	T ₁₂	V ₃ N ₁₂₀

Note (i) This experiment will be conducted on fresh site separately selected during Kharif and rabi seasons. All the 12 treatments will be randomised during Kharif as well as in rabi seasons.

Note (ii) - Levels of fertilizers and varieties

V₁ - presently cultivated standard variety.

V₂ and V₃ - pre released varieties.

N₀ - No nitrogen, N₄₀ - 40 kg N/ha.

N₈₀ - 80 kg N/ha, N₁₂₀ - 120 kg N/ha.

(iii) Basal dose

60 kg P₂O₅ and 60 kg K₂O/ha.

Type C : Fertilizer requirement of a fixed single year two crop sequence under resource constraints.

No. of plots	Treatments	Levels of fertilizer combinations	
		Kharif season	Rabi season
10	T ₁	N ₀ P ₀ K ₀	N ₀ P ₀ K ₀
	T ₂	N ₁₂₀ P ₆₀ K ₆₀	N ₁₂₀ P ₆₀ K ₆₀
	T ₃	N ₉₀ P ₄₅ K ₄₅	N ₁₂₀ P ₆₀ K ₆₀
	T ₄	N ₉₀ P ₉₀ K ₀	N ₉₀ P ₀ K ₉₀
	T ₅	N ₉₀ P ₀ K ₉₀	N ₉₀ P ₉₀ K ₀
	T ₆	N ₆₀ P ₃₀ K ₃₀	N ₉₀ P ₉₀ K ₀
	T ₇	N ₆₀ P ₆₀ K ₀	N ₉₀ P ₄₅ K ₄₅
	T ₈	N ₆₀ P ₀ K ₃₀	N ₆₀ P ₆₀ K ₀
	T ₉	N ₆₀ P ₃₀ K ₃₀	N ₆₀ P ₃₀ K ₃₀
	T ₁₀	N ₆₀ P ₀ K ₀	N ₆₀ P ₃₀ K ₃₀

Note: This experiment will be conducted on the same site during Kharif and Rabi seasons and the treatments to be applied to different plots will be as given down. The ten treatments will be randomised when applied to ten different plots in a field during Kharif season only, during Rabi season, no randomization of treatments will be done and each plot treated in Kharif season will receive the corresponding treatments as shown above.

(ii) Levels of fertilisers:-

N_0 - No nitrogen, N_{60} - 60 kg N/ha.

N_{90} - 90 kg N/ha, N_{120} - 120 kg N/ha.

P_0 - No phosphorus, P_{30} - 30 kg P_2O_5 /ha.

P_{45} - 45 kg P_2O_5 /ha, P_{60} - 60 kg P_2O_5 /ha.

P_{90} - 90 kg P_2O_5 /ha,

K_0 - No potassium, K_{30} - 30 kg K_2O /ha.

K_{45} - 45 kg K_2O /ha, K_{60} - 60 kg K_2O /ha.

(iii) Crops: Experiment will be conducted on a cereal-cereal rotation.

During the year 1978-79, seven experiments viz., Nos. 1(a), 1(e), 2, 3, 4, 8 and 9(a) in Kharif season, six experiments viz., 1(a), 1(e), 3, 4, 8 and 9(a) in Rabi season and three experiments viz. 1(a), 1(d), 8 in summer season respectively were planted. As per the programme all the seven experiments were successfully conducted during the Kharif season. In the Rabi season four experiments were planted and when the lay out of the remaining experiments were in progress an unprecedented flood situation arose and the entire field was under water for a week which resulted in the damage of standing crop and in the silting of the field. Hence all the experiments laid out in the Rabi season had to be discarded. In these circumstances the results of successful experiments of Kharif and summer alone are presented and discussed. In the case of experiments 1(a) and 1(e) the data of three seasons are to be collectively taken to interpret the results pertaining to crop sequences and since the second crop was lost, the data of these experiments of Kharif season are not included in this report.

1. Experiment No.1(d)

Studies on Intercropping

The experiment is in the field and the harvesting of both the main crop and the intercrops will take a couple of months. The cowpea and groundnut have put forth luxuriant vegetative growth and have started smothering the main crop of Tapioca. The large scale deposition of sand and silt due to the floods of preceding season might have influenced this abundant vegetative growth of legumes.

2. Experiment No.2

Manurial requirement of a fixed crop rotation

This is a long term experiment started during the Kharif season 1972-73 and now it has completed 13 seasons of experimentation by Kharif 1978-79. The data of Kharif experiments are presented under tables 2.1, 2.2 and 2.3.

Table 2.1

Grain yield of rice (Q/ha) as influenced by applied phosphorus during Kharif 1978-79

Levels of P_2O_5 (kg/ha)	Direct effect	Residual effect	Cumulative effect
0	49.66	48.48	48.33
30	45.91	49.83	49.29
60	49.04	48.40	47.38
CD at 5%	NS	NS	NS

From the table above, it is observed that the direct residual and cumulative effects of applied phosphorus is not significant at any of the levels. The fact that no phosphorus plots (P_0) gives as much grain yield as that of plots receiving 60 kg P_2O_5 , shows that application of phosphorus does not give any response with regard to grain yield in Karamana soils. This result is in agreement with the results of previous years.

Table 2.2

Grain yield of rice (Q/ha) as influenced by applied potash during 1978-79

Levels of K_2O (kg/ha)	Direct effect	Residual effect	Cumulative effect
0	48.52	48.37	48.07
30	47.89	49.44	48.59
CD at 5%	NS	NS	NS

The data presented above show that the direct, residual and cumulative effects of applied potash are nonsignificant. In the direct phase there is a tendency to reduce the grain yield but in the residual and cumulative phases the tendency

is to increase the grain yield by the application of potash. In all these cases the differences in yield are not significant. This result confirms the previous years results and it reveals that potash application has no advantage in increasing grain yield in Karamana soils.

The grain yield data as influenced by the Farm Yard Manure is presented hereunder.

Table 2.3

Grain yield of Rice (Q/ha) as influenced by applied farm yard manure during Kharif 1978-79.

Levels of F.Y.M. (kg/ha)	Direct effect	Residual effect	Cumulative effect
0	47.85	49.15	47.74
15000	48.56	48.66	48.92
CD at 5%	NS	NS	NS

As in the case of phosphorus and potash the effect of applied Farm Yard Manure is not significant in any of the phases. The nonresponse in grain yield by the application of 15000 kg farm yard manure/ha may be due to the application of uniform dose of 120 kg N/ha in the form of fertilizer and the accumulation of silt clay and organic matter consequent to the periodic flooding of the area. Thus it is observed that in general there is no beneficial effect by the application of P, K and F.Y.M. separately and in combination.

3. Experiment No.3

Long range effect of continuous cropping

The grain yield data of the experiment as influenced by nitrogen, phosphorus and potash are presented under Table 3.1.

Table 3.1.

Grain yield of rice (Q/ha) as influenced by the applied Nitrogen, Phosphorus and Potash during Kharif 1978-79.

Levels of N (kg/ha)	Grain yield	Levels of P (kg/ha)	Grain yield	Levels of K(kg/ha)	Grain yield
0	27.06	0	37.90	0	38.75
40	32.29	40	38.20	40	37.77
80	38.58	80	38.68		
120	43.91				
CD at 5%	2.734		NS		NS

The table above show that only nitrogen has significantly influenced grain yield of Jaya variety. Application of 120 kg N/ha also gave a profitable yield of 43.91 q/ha. By the application of nitrogen from 0 to 120 kg, there is a response of 14 kg grain per kilogram of applied nitrogen. In the case of phosphorus and potassium no significant beneficial effect on grain yield is noticed.

Excepting the interaction effect of nitrogen and potash all other interactions are nonsignificant. The combined effect of N and K are presented in Table 3.2.

Table 3.2

Effect of N and K on the grain yield (Q/ha) during Kharif 1978-79

	N ₄₀	N ₈₀	N ₁₂₀	Mean
K ₀	31.24	41.34	43.67	38.75
K ₄₀	33.34	35.82	44.15	37.77
Mean	32.29	38.58	43.91	38.26

Mean yield of N₀ P₀ K₀ = 27.06

CD of difference of means of NK combination = 3.86

From the table presented above it is seen that there is a significant negative interaction between N and K.

In conclusion, it can be stated that there is response only to N application in Karanana soil.

4. Experiment No.4

Agronomic evaluation of new promising pre release rice varieties.

The yield data of experiment conducted during Kharif 1978-79 is tabulated and presented under tables 4.1, 4.2 and 4.3 and Chart I and II. The analysis of variance table show that Date of planting, Date of planting x Nitrogen, Date of planting x Varieties and Nitrogen x Varieties are highly significant. The varietal difference and the Date x Nitrogen x Variety combination are seen to be significant at 5% level only.

The response on grain yield with different levels of nitrogen and the extent of effects due to dates of planting and the interaction effect between these two factors are presented below.

Table 4.1

Effect of date of planting on grain yield of rice (Q/ha) during Kharif 1978-79

Varieties	D ₁ Normal data (24.6.1978)	D ₂ (12.7.78)	D ₃ (26.7.78)
Thriveni	30.10	23.37	27.05
Culture 1907	35.18	24.33	25.11
IR-36	31.55	27.11	28.47
	S.E.	CD at 5%	
Dates within varieties	1.74	3.46	

From the table above it is very clear that the normal date of planting is definitely superior for getting higher grain yield for all the varieties viz. Thriveni, Culture 1907 and IR-36, during Kharif season. Delayed planting considerably reduced the yield of all varieties. But in the case of IR-36 delayed planting by one month did not reduce the yield significantly from that of normal date of planting. This indicates that IR-36 shows tolerance for delayed planting.

The effect of applied nitrogen in relation to the individual varieties on grain yield are presented under table 4.2.

Table 4.2

Effect of applied Nitrogen in relation to individual varieties (Q/ha) during 1978-79

N levels	N ₀	N ₄₀	N ₈₀	N ₁₂₀	Mean
Variety					
Thriveni	26.21	28.11	28.28	24.75	26.84
Culture 1907	27.46	31.88	28.43	25.06	28.21
IR-36	25.70	27.99	31.71	30.86	29.04
Mean	26.46	29.30	29.47	26.89	28.03
C.D. for N means		- 2.96			
C.D. for V means		- 1.62			
C.D. for V means at the same levels of N	0	0	- 3.23		
C.D. for N means at the same levels of V means	0	0	0	- 3.94	

The table 4.2 above and Chart II shows that there is significant response for grain yield by the application of higher doses of nitrogen. The optimum level of N for maximizing production varied between varieties. Thriveni has maximum potential of 28.56 Q at 53.8 kg of N. Culture 1907 has the maximum yield potential of 30.79 Q. at 70.9 kg N. Optimum level of N for IR-36 is 108.9 kg at which level the yield is

expected to be 31.22 Q/ha. The table reveals that the Culture 1907 performs better at 40 kg N/ha and produces as much grain yield as that of IR-36 at 80 kg N level. The time of planting and N requirement of the varieties are given below.

Variety	Date of planting	Nitrogen level
Thriveni	Last week of June	40 kg N/ha
Culture 1907	-do-	40 kg N/ha
IR-36	Last week of June and last week of July	80 kg N/ha

Table 4.3

Data on nutrient uptake - Kharif season

	Nitrogen uptake (kg N/ha)			Total
	D ₁	D ₂	D ₃	
V ₁	69.95	62.25	78.71	210.91
V ₂	93.32	62.56	70.81	226.69
V ₃	80.79	76.96	78.89	236.56
Total	243.98	201.77	228.41	674.16
	Phosphorus uptake (kg P ₂ O ₅ /ha)			Total
	D ₁	D ₂	D ₃	
V ₁	16.1	15.5	21.4	53.0
V ₂	20.3	16.0	18.8	55.1
V ₃	14.9	12.2	19.1	46.2
Total	51.3	43.7	59.3	154.3
	Potash uptake (kg K ₂ O/ha)			Total
	D ₁	D ₂	D ₃	
V ₁	132.22	144.74	130.90	407.96
V ₂	241.86	129.86	124.75	496.47
V ₃	179.79	157.24	121.90	458.93
Total	553.87	431.84	377.55	1363.36

The data given under table 4.3 show that the nitrogen and potash uptake are more when Culture 1907 and IR-36 are planted at the normal date. The yield data presented in Table 4.1 also show that the yield is more in the 1st date of planting followed by third date of planting. Hence it can be presumed that the soil and climatic factors, might have been favourable during the 1st date of planting for the uptake of more plant nutrients which in turn has resulted in higher production.

5. Experiment No.8

Fertilizer economy through organic manure

According to the Technical programme this experiment had to be conducted in the same site during Kharif and Rabi seasons and the residual effect studied during the 3rd crop season. Since the Rabi crop was damaged due to floods, the data of Kharif season alone are processed and presented.

Table 8.1

Grain yield (Q/ha) during Kharif 1978-79
(Direct effect)

	N ₀ P ₀ K ₀	N ₃₀ P ₁₅ K ₁₅	N ₆₀ P ₃₀ K ₃₀	N ₉₀ P ₄₅ K ₄₅	N ₁₂₀ P ₆₀ K ₆₀	Mean
F ₀	33.73	35.60	41.50	35.55	45.25	38.33
F ₁₂	34.23	40.67	40.95	41.34	42.49	39.94
Mean	33.98	38.14	41.23	38.44	43.87	39.13

C.D. for F means = 3.503

C.D. for fertilizer treatment = 5.539

C.D. for combinations = 7.833

The data presented in Table 8.1 show that the effect of farm yard manure in increasing grain yield either singly or in combination with fertilizers is not significant. From the above it is quite clear that organic manure may not be a substitute for fertilizers in Kerala since its cost is prohibitive.

6. Experiment No.9(a)

Slow release and different grades of urea briquettes on rice.

The yield data of Kharif season is processed and presented under Table 9(a):1.

Table 9(a):1

Grain yield data on the response of different sources and levels of nitrogen (Q/ha)

Source/ levels of N kg/ha	S ₀ No ni- trogen	S ₁ (Urea at plant- ing)	S ₂ (Urea split)	S ₃ (Urea brique- ttes 1 g. size)	S ₄ (Urea bri- quettes 1.9 g size)	S ₅ (Urea bri- quettes 2.9 g size)	S ₆ (Sul- phur coa- ted urea)	Mean
40		32.50	34.85	32.69	29.61	34.63	32.77	32.84
80		38.30	39.90	35.30	35.29	41.27	38.15	38.04
120		35.20	41.43	39.02	34.49	38.30	41.99	38.41
Mean	28.73	35.33	38.73	35.67	33.13	38.07	37.64	

C.D. of difference between two source means including control = 4.296

C.D. of difference between two level means = 2.040

C.D. of difference between control and any level mean = 3.362

C.D. of difference between the level means for the same source = 4.998

C.D. of difference between two source means for same level of nitrogen = 5.922

C.D. of difference between control mean and a source mean for any level = 5.173

It is observed that the response of nitrogen to grain yield is highly significant. For the variety Thriveni 80 kg N/ha is found sufficient.

From the data above it is seen that only urea briquettes (1.9 g size) alone is inferior and all others are on par. All the sources showed greater efficiency at 80 kg N/ha level (Chart III). However traditional method of urea split application is found to give the highest yield. Hence considering the relative efficiency, less expense on fertilizer application and the availability of the materials it is seen that urea split application is definitely best in Karamana.

Chart I

EFFECT OF DATE OF SOWING ON RICE VARIETIES
EXPT.No.4 MARC, KARAMANA (KHARIF 1978-79)

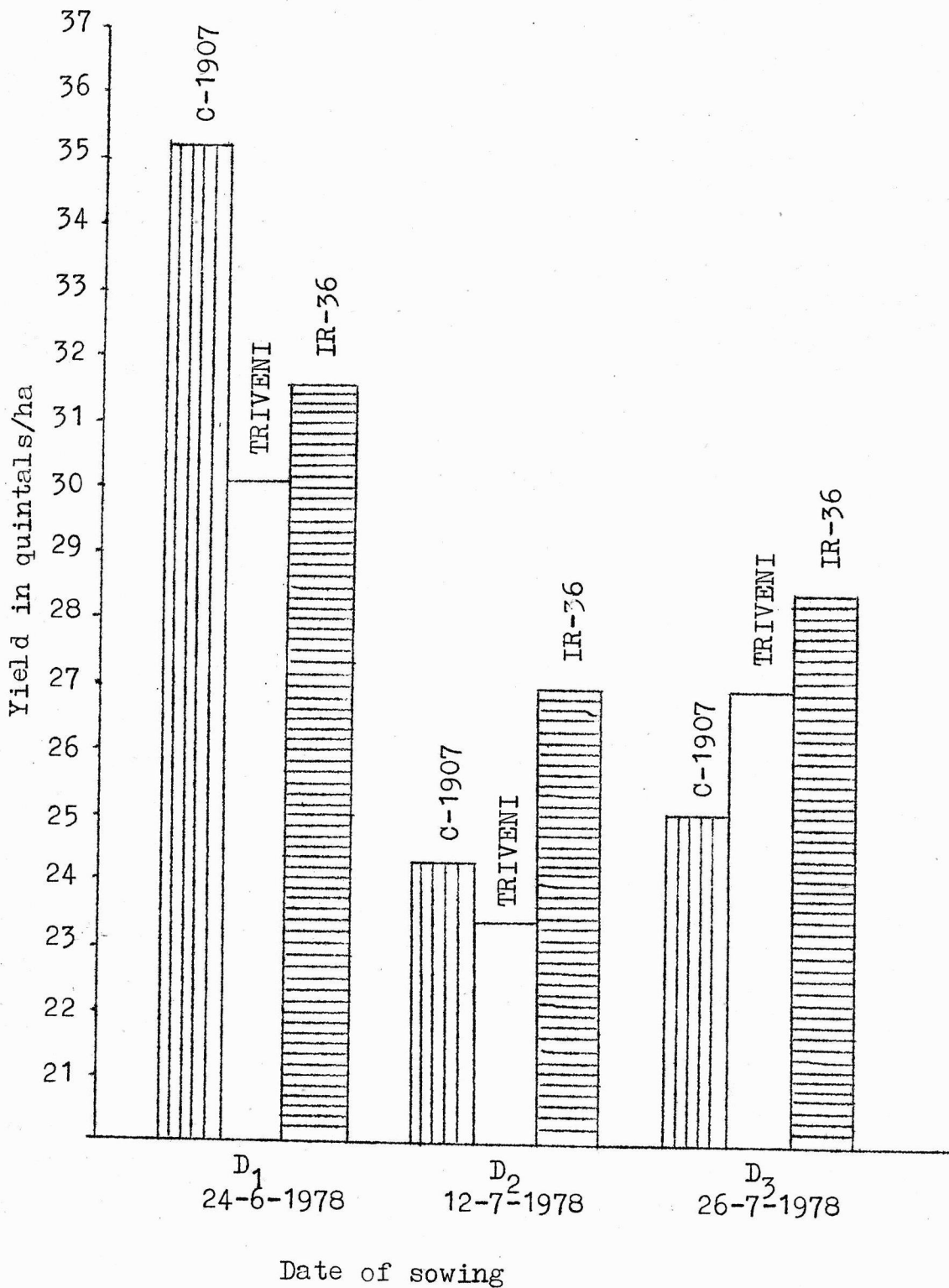


Chart II

RESPONSE OF VARIETIES TO NITROGEN LEVELS
(EXPT. No.4, MARC, KARAMANA)

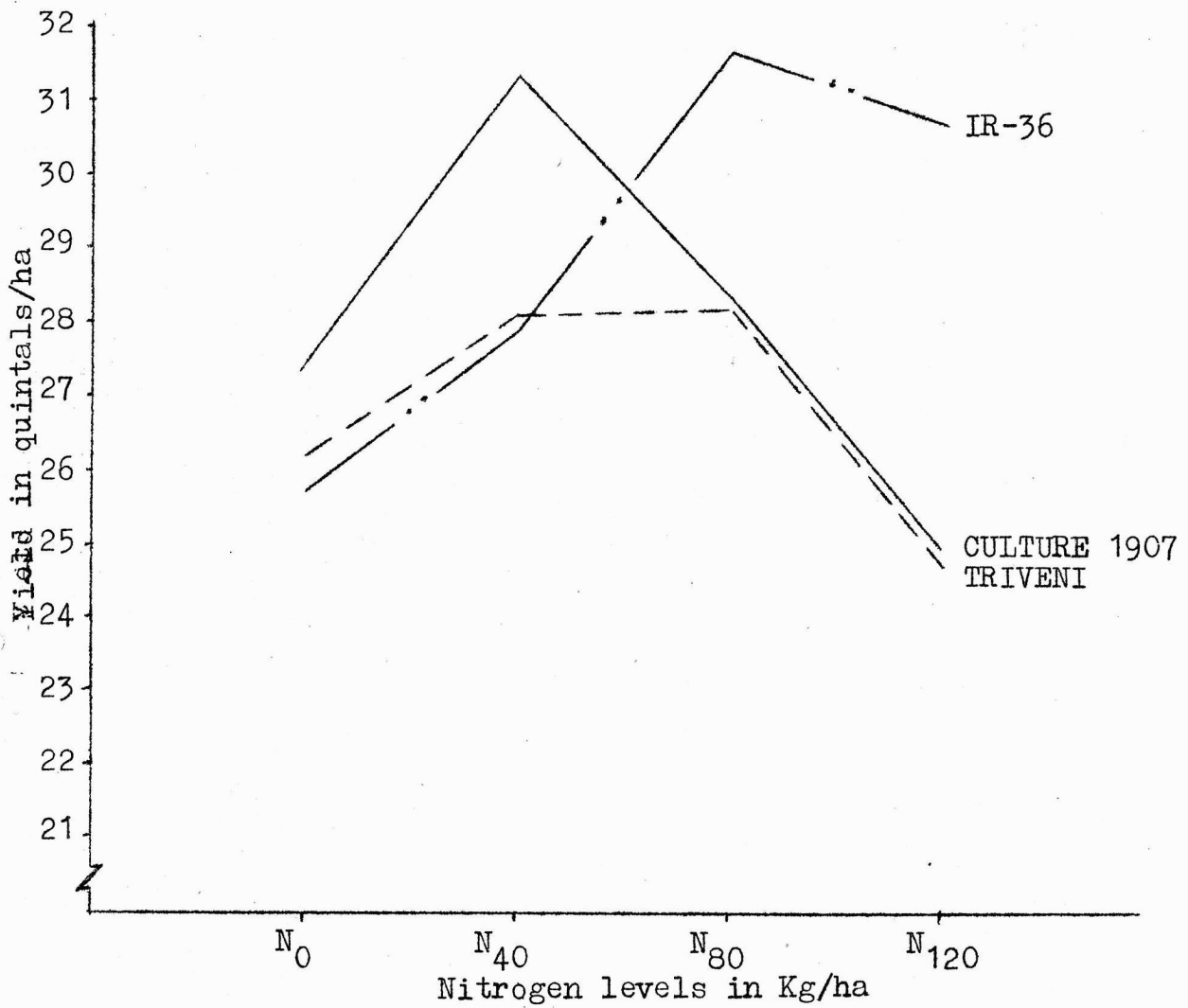
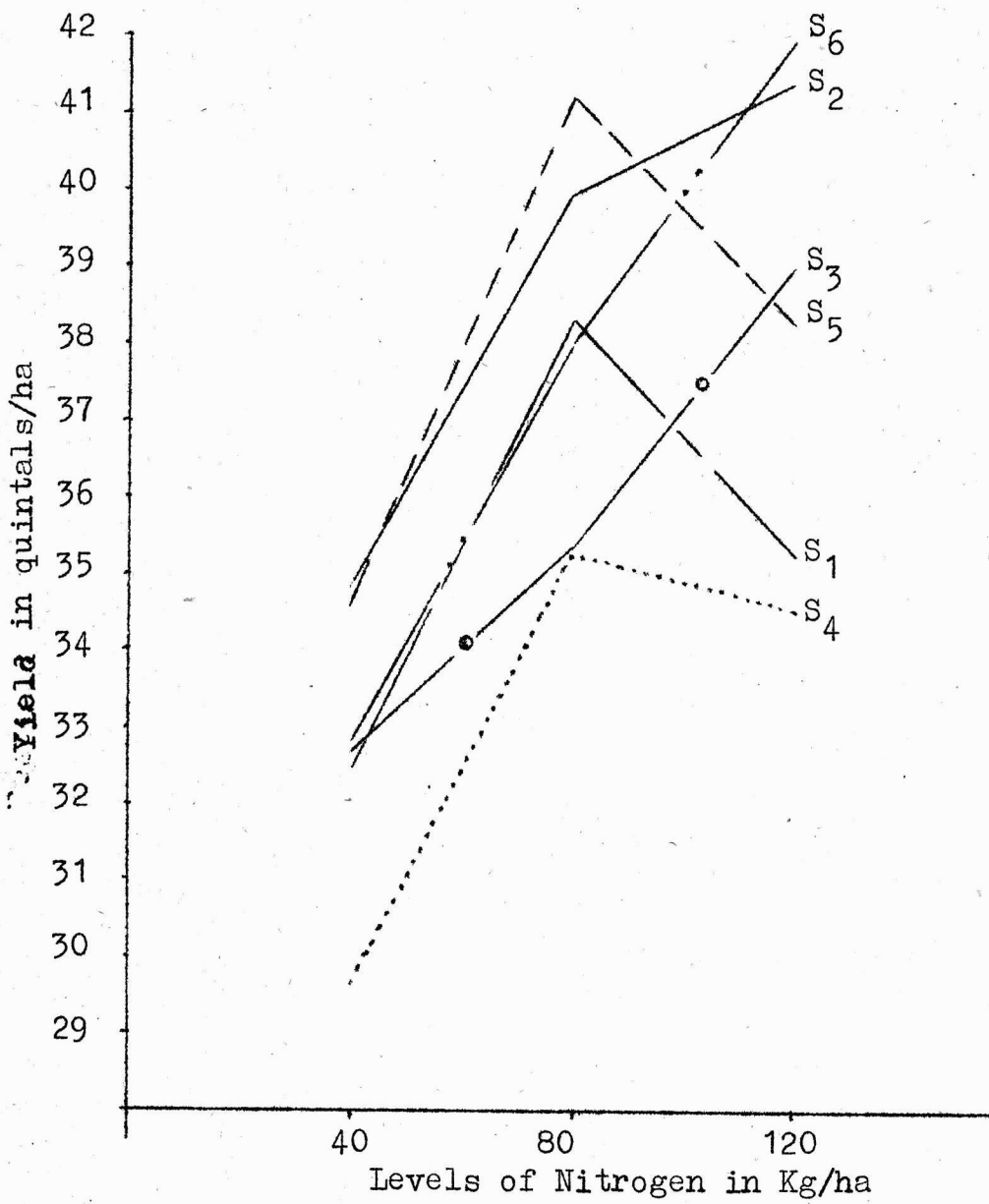


Chart III

RESPONSE OF DIFFERENT SOURCES OF NITROGEN ON
JAYA - KHARIF 1978-79
(EXPT. No.9a, MARC, KARAMANA)

Control plot yield - 28.73 Q/ha.



RESULTS AND DISCUSSION

TYPE-A EXPERIMENT

The data of a total of 146 successful experiments have been statistically analysed and presented.

Response towards Nitrogen

Kozhikode District

In zones 1 and 3 covering the blocks Badagara, Kunnummal and S. Battery, significant response was obtained upto 120 kg N/ha over control. But the grain yield at 120 kg N was on par with 80 kg nitrogen. In respect of zones 2 and 4, i.e. in Balussery, Perambra, Chevayoor and Kozhikode blocks the response was not significant for any of the levels of nitrogen, during Kharif season (Table A1). On the basis of N response already obtained the following conclusions can be drawn. For zone 1, 80 kg N/ha is required whereas for zone III 40 kg N seems to be sufficient. No significant difference has been obtained for zone II and IV. However, for the district as a whole, the suggested nitrogen dose is 80 kg N/ha (Table A2). Response curve shows that among the four zones, zone I responded better at all the levels of nitrogen (Chart A.1).

In Rabi, except zone 3, all other zones covering the blocks Badagara, Kunnummal, Balussery, Perambra, Chevayoor and Kozhikode the response in grain yield is significant for all the three N levels and all of them are on par (Table A4). Zones 1 and 4 showed a trend of reduction in response for a dose higher than 80 kg N/ha, whereas zones 2 and 3 showed progressive increase. But the increase is not seen significant. The maximum yield was obtained at 80 kg N level in zone 1 and 2. The suggested dose of N for different zones are given in Table A.5. It shows that 40 kg N/ha is sufficient in Badagara, Kunnummal, Balussery, Perambra, Chevayoor and Kozhikode blocks to get good grain yield. In zone 3 covering S.Wynad area, no significant response was obtained

for any of the nitrogen levels tried. For the district as a whole on the average, 80 kg N/ha was found to be the best dose with an increase of 7.92 q. grain/ha over control during Rabi. This trend is also very clearly seen from Chart A.2.

It has also been generally observed that the increase in grain yield was at a higher level in Kharif season than in Rabi season in almost all the blocks. This reveals that the applied nitrogen is more efficiently utilised by the crop during Kharif season (Chart A.10).

Kottayam District

All the four zones covering the blocks Vaikom, Kaduthuruthy, Pallam, Madappally I & II, Lalam and Uzhavoor give significant response towards all the levels of nitrogen over control during Kharif (Table A.1) and maximum grain yield was obtained at 120 kg N/ha. Response curve (Chart A.4) reveals that zones, 1, 3 and 4 show similar trend to increase the grain production at higher levels of N, especially upto 80 kg N/ha. From table A.3 it is seen that in respect of zone 1 i.e., Vaikom and Kaduthuruthy blocks an increase of 14.44 quintal grain/ha is obtained for 120 kg N/ha while for zone 3 i.e. Madappally block it is 5.32 quintal grain/ha for 80 kg N/ha. For zones 2 & 4 the increase in yield is significant at 40 kg N/ha level only. For the district as a whole on the average, 80 kg N/ha is found to be the best dose of N with an increase of 9.02 quintal grain/ha during Kharif season.

During Rabi, all the zones except zone 2, give significant response even upto 120 kg N/ha (Table A.4). In zone 2 i.e. Pallam Block, response is not seen significant for any of the nitrogen levels even though higher yield is obtained at 80 kg N level. Zones, 1, 3 and 4 covering the blocks Vaikom, Kaduthuruthy, Madappally I & II, Lalam and Uzhavoor blocks, show almost linear trend with the different doses of N in increasing the grain production. Zone 2 marks a reduction in grain yield after 80 kg N/ha (Chart A.5). The best doses of N for the different zones are given in table A.6. This shows

that the requirement of N for zones 1 and 3 is 120 kg/ha, whereas for zone 4, it is 80 kg/ha, whereas for the entire district 80 kg N/ha (increase 5.19 q/ha) is found to be required during Rabi season.

Thus for the district of Kottayam 80 kg N/ha during Kharif and Rabi seasons are found to be a sufficient dose of N, the increase ⁱⁿ grain yield being 9.02 and 5.19 q/ha during Kharif and Rabi seasons respectively. Similar to that of Kozhikode district, in Kottayam also, the applied nitrogen is more efficiently utilized during Kharif season than in Rabi season as evidenced from the grain yield (Chart A.10 and A.11).

RESPONSE TOWARDS PHOSPHORUS

Kozhikode District

During Kharif the phosphorus response is generally not found to be significant. In zone 1 covering Badagara and Kunnummal blocks, the higher levels of P considerably decrease the yield after 40 kg P_2O_5 /ha, whereas in zone 2 i.e. Balussery and Perambra blocks, positive increase in grain yield is obtained for all the P levels tried, and even significant positive increase of 5.11 q/ha is obtained when 60 kg P_2O_5 /ha is applied (Table A.1). In zone 4, Chevayoor and Kozhikode blocks there is linear increase in the response though at lower levels the response was negative. Table A.2 clearly reveals that in Kozhikode district during Kharif generally there is no beneficial effect due to the application of phosphorus. However, in zone 2, application of 60 kg P_2O_5 /ha is found to give better results.

During Rabi, positive and significant response is obtained for 40 kg and 60 kg P_2O_5 /ha over control in zones 2 and 3 covering Balussery, Perambra and S.Battery (Table A.4). The doses suggested for these zones are 40 and 20 kg P_2O_5 /ha respectively with an increase of 6 and 5.79 q. of grain/ha over control (Table A.4). In case of zone 1 and 4, the response is not significant. However, there is a trend that the yield increases upto a level of 40 kg P_2O_5 /ha (Chart A.6).

Thus for the district on the average the best doses of P is found to be 40 kg P_2O_5 /ha with an increase in grain yield of 3.97 q/ha over control during Rabi and as observed there is no need of applying phosphorus during Kharif season.

Kottayam District

During Kharif season the response of phosphorus is found to be significant in three of the zones viz. 1, 3 and 4 covering the blocks Vaikom, Kaduthuruthy, Madappally I and II, Lalam and Uzhavoor (Table A.1). In all these cases the lower level of phosphorus i.e. 20 kg P_2O_5 /ha gives the maximum increase in grain yield over control (Table A.3). In zone 2, the trend is just reverse, where the response increases as the phosphorus level increases and 60 kg P_2O_5 /ha gives the maximum increase in grain yield of 3.53 q/ha. But this is not statistically significant. Further it is noted that in zone 1 negative response is observed when 60 kg P_2O_5 /ha is applied whereas in Pallam, negative response is observed only at lower level of 20 kg P_2O_5 /ha. However, for the district as a whole on the average, 20 kg P_2O_5 /ha with a positive increase of 4.01 q/ha is found to be sufficient during Kharif. The response curves are given in Chart A.7.

During Rabi season also, similar trend as that of Kharif is observed. In zone 2, i.e. in Pallam block there is no significant response to phosphorus for all the three levels (Chart A.8). However, the best dose of P for the district is found to be 20 kg P_2O_5 /ha (Table A.6). Hence it is seen that for the district as a whole phosphorus need be applied only at its lower level of 20 kg P_2O_5 /ha in both the seasons. This fact is clearly illustrated in Chart A.9.

RESPONSE TO POTASSIUM

Kozhikode District

During Kharif response to potassium is found to be significant only in zone 3 i.e. S. Battery block wherein an increase in grain yield of 7.84 q/ha was obtained for 20 kg K_2O /ha. In some cases instead of increasing the grain yield, the application of Potash reduces the grain yield (Table A.1). However,

the trend shows that 20 kg K_2O /ha is a sufficient dose of K in zone 3 covering S.Battery, whereas in other zones no response to applied potash is seen during Kharif (Table A1 and A2). For the district as a whole on the average 20 kg K_2O /ha is needed during the Kharif season (Table A.2).

During Rabi all the zones recorded significant response to applied K at its higher level of 60 kg K_2O /ha. The zones I and II covering the blocks Badagara, Kunnummal, Balussery and Perambra the response is significant even at the lower level of 20 kg K_2O /ha and it is on par with 60 kg K_2O /ha. In zone 1 the maximum response of 9.30 q/ha is obtained for 20 kg K_2O /ha (Table A.4). The recommended dose of K in respect of each of the zones is given in table A5 which shows that in zone 1 and 2 potassium need be applied only @ 20 kg K_2O /ha and in zones 3 and 4 it has to be applied at a higher dose of 40 kg and 60 kg K_2O /ha respectively for getting maximum grain production. However the general recommendation for the whole district during Rabi season is 20 kg K_2O /ha.

From Chart A6, it is found that the behaviour in zone 2 and 3 in respect of the said nutrient is just opposite and dissimilar to each other during the two seasons, while the trend of zone 1 is the same in both the seasons. Here also the utilization efficiency of Potassium is more in Kharif season.

Kottayam District

During Kharif, significant response is observed in case of zones 1 and 3 at 60 kg K_2O /ha and 20 kg K_2O /ha respectively (Table A.1). Zone 1, Vaikom and Kaduthuruthy blocks shows significant increase in response only at 60 kg K_2O level. The maximum response of 9.16 q/ha is obtained in zone 1 when 60 kg K_2O /ha is applied. In zones 2 and 4 negative response is observed though it is not statistically significant. This shows that in this area i.e. Pallam, Lalam and Uzhavoor blocks, there is no need of applying potassium fertilizer as its application reduces the grain yield below the control plot yield (Chart A.7).

However, for the district as a whole on the average 60 kg K_2O /ha with a response of 4.47 q/ha is recommended for getting a good yield (Table A.3).

During Rabi, significant response is observed in zone 3 and 4 at 20 kg K_2O /ha level. Zone 2 does not show significant response to any of the K levels tried, while zone 1 shows positive and significant response only at the higher level of K i.e. 60 kg K_2O /ha (Table A.4). The recommended dose of K_2O for zone 1 is 60 kg K_2O /ha whereas for zone 3 and 4 it is 20 kg K_2O /ha. The recommendation for the district as a whole is 20 kg K_2O /ha (Table A.6).

As in the case of phosphorus, K is also subject to considerable seasonal variations.

RESPONSE TO LIME

Kozhikode District

The response to lime application is found to be nonsignificant in all the zones during Kharif as well as in Rabi seasons. In Rabi, in zone 2 even negative response is observed. This shows that the lime application is not beneficial for rice crop in Kozhikode District (refer Table A.7).

Kottayam District

Here only zone 2 i.e. Pallam block area shows significant response of 6.12 q/ha towards lime application. During Kharif the response in all other zones were nonsignificant and in zone 4 even negative response is observed (Table A.8).

During Rabi, positive and significant response is observed only in zone 3. But for the district as a whole on the average, a significant response of 1.67 q/ha is observed. This shows that application of lime has got some beneficial effect during Rabi though in Kharif it is not advantageous.

Table A.1

Increase in grain yield by the application of different levels of N, P, K in Jaya during Kharif 1978-79 (Type A expt.)

Dis- trict	Zone Block	N.P.K. 0 0 0	N (kg N/ha)			P (kg P ₂ O ₅ /ha)			K (kg K ₂ O/ha)			C.D.	
			40	80	120	20	40	60	20	40	60		
		No. of trials				(with 40 kg N)	(with 80 kg N)	(with 120 kg N)	(with 40 kg N + 20 kg P ₂ O ₅)	(with 80 kg N + 40 kg P ₂ O ₅)	(with 120 kg N + 60 kg P ₂ O ₅)		
Kozhi- kode	1. Badagara Kunnummal	6	17.73	8.55*	18.69*	21.54*	4.19	3.78	-0.08	5.00	-0.14	4.56	7.26
	2. Balussery Perambra	7	19.40	3.62	3.91	4.95	3.44	2.30	5.11*	0.94	4.80	1.78	5.06
	3. S. Battery	8	43.15	8.75*	11.97*	13.62*	-3.31	3.18	-2.61	7.84*	-4.10	1.79	6.06
	4. Chevayoor Kozhikode	9	31.10	5.75	6.37	7.24	-2.22	-1.24	1.54	6.43	3.90	4.06	7.33
			28.91	6.61*	9.75*	11.27*	0.09	1.77	0.94	5.24*	1.17	3.02	3.28
Kottayam	1. Vaikon Kaduthu- ruthy	10	35.82	7.70*	11.34*	14.44*	5.39*	5.40*	-0.30	3.55	0.50	9.16*	5.16
	2. Pallam	9	27.16	5.32*	5.11*	6.16*	-0.59	2.32	3.53	0.12	-0.28	-0.81	4.32
	3. Madappally-I Madappally-II	9	26.13	5.63*	9.30*	10.30*	4.46*	5.01*	-5.15*	6.36*	3.99*	5.28*	3.27
	4. Lalam Uzhavoor	0	29.15	7.68*	9.26*	12.79*	6.63*	5.22	3.05	-0.31	0.50	3.74	5.44
			29.73*	6.61*	9.02*	11.02*	4.01*	4.51*	3.02*	2.46*	1.16	4.47*	3.31

Table A.2.

Results of experiments conducted at Kozhikode district during the Kharif 1978-79
Type A - Variety Jaya.

The best dose of nitrogen, phosphorus and Potassium (dose in kg/ha and response in q/ha)

Zone	Blocks	No. of trials	N		P		L		Line		Control yield	Remarks
			Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/kg)		
Zone 1	Badagara Kunnunnal	6	80	18.69	NS	-	NS	-	NS	NS	17.73	
Zone 2	Balussery Peranbra	7	NS	-	60	5.11	NS	-	NS	NS	19.40	
Zone 3	S. Battery	8	40	8.77	NS	-	20	7.84	NS	NS	43.15	
Zone 4	Chevayoor Kozhikode	9	NS	NS	NS	-	NS	-	NS	NS	31.10	
District			80	9.75	NS	-	20	5.24	NS	NS	28.91	

Table A.3

Results of experiments conducted at Kottayam District during Kharif 1978-79.

Type A: Variety Jaya.

The best dose of N, P and K were as follows (dose in kg/ha)												
Zone	Blocks	No. of trials	N		P		K		Line		Control yield	Remarks
			Dose	Increase in grain yield in q/ha	Dose	Increase in grain yield in q/ha	Dose	Increase in grain yield in q/ha	Dose	Increase in grain yield in q/ha.		
Zone 1	Vaikom Kaduthuruthy	10	120	14.44	20	5.39	60	9.16	NS	NS	35.82	
Zone 2	Pallan	9	40	5.32	NS	NS	NS	..	500	6.12	27.16	line effect is significant
Zone 3	Madappally-I Madappally-II	9	80	9.30	20	4.46	20	6.36	NS	NS	26.13	
Zone 4	Lalan Uzhavoor	9	40	7.68	20	6.63	NS	--	NS	NS	29.15	
District			80	9.02	20	4.01	60	4.47	500	NS	29.73	

Table A.4.

Response of N,P,K and Line in grain yield of rice (q/ha) during Rabi -1978-79.

Type A Expt.

Dis- trict	Zone	Blocks	No. of trials	Con- trol	N (kg N/ha)			P (kg P ₂ O ₅ /ha)			K (kg K ₂ O/ha)			C.D 5%
					40	80	120	20 with 40 kg N	40 with 80 kg N	60 with 120 kg N	20 with 40 kg N +20 kg P ₂ O ₅	40 + 80 kg N 40 kg P ₂ O ₅	60 with 120 kg N + 60 kg P ₂ O ₅	
Kozhi- kode (variety used Jaya)	1	Badagara Kunnumal	10	17.38	6.74*	10.71*	9.30*	0.63	3.44	4.03	9.30	0.51	7.64*	4.47
	2	Balusseri Perambra	11	21.68	6.16*	6.87*	7.96*	1.00	6.00*	4.20*	4.70*	1.09	7.67*	3.77
	3	S.Battery	2	31.13	1.05	1.85	3.51	5.79*	5.55*	4.49*	2.10	8.07*	9.43*	3.83
	4	Chevayoor Kozhikode	11	19.35	5.15*	7.54*	6.71*	-0.82	2.15	1.94	1.32	2.30	4.11*	3.72
District			34	20.22	5.70*	7.92*	7.69*	0.59	3.97*	3.43*	4.80*	1.72	6.61*	2.17
Kottayam (Variety used Jyothi)	1	Vaikon Kaduthu- ruthy	12	28.85	2.89*	5.07*	6.25*	4.46*	1.99	1.27	-0.10	-0.05	3.12*	2.81
	2	Pallam	6	39.52	4.15	5.86	5.53	0.75	1.10	5.95	4.29	1.35	-3.53	6.70
	3	Madappally-I Madappally-II	14	34.35	4.41*	6.29*	8.27*	6.23*	5.73*	5.64*	4.49*	5.28*	6.08*	2.58
	4	Lalan Uzhavoor	13	30.69	1.42	3.81*	5.30*	2.31*	1.67	1.64	2.47*	2.67*	2.05	2.19
District			45	31.72	3.11*	5.19*	6.51*	3.89*	2.94*	3.36*	2.66*	2.58*	2.85*	1.63

Results of experiments conducted at Kozhikode District during Rabi 1978-79.

Type A - Variety: Jaya.

The best dose of N,P,K and the effect of Line are as follows (dose in kg/ha, response in q/ha)

Zone	Blocks	No. Of trials	N		P		K		Line		No manure yield	Remarks
			Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)		
Zone 1	Badakara Kunnunnal	10	40	10.74	NS	--	20	9.30	NS	NS	17.38	
Zone 2	Balussery Perambra	11	40	6.16	40	6.00	20	4.70	NS	NS	21.68	
Zone 3	S.Battery	2	NS	--	20	5.79	40	8.07	NS	NS	31.13	negative response for lime
Zone 4	Chevayoor Kozhikode	11	40	5.15	NS	--	60	4.11	NS	NS	19.35	
District		34	80	7.92	40	3.97	20	4.80	NS	NS	20.22	

Table A.6

Results of experiments conducted at Kottayam District during Rabi 1978-79

Type-A - Variety : Jyothi.

The best dose of nitrogen, phosphorus and potassium were as follows (dose in kg/ha - response in q/ha)

Sone	Blocks	No. of trials	N		P		K		Line		Control yield	Remarks
			Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)	Dose	Increase in grain yield (q/ha)		
Zone 1	Vaikom Kaduthuruthy	12	120	6.25	20	4.46	60	3.12	NS	--	25.85	
Zone 2	Pallan	6	NS	NS	NS	NS	NS	NS	NS	--	39.52	
Zone 3	Madappally-I Madappally-II	14	120	8.27	20	6.23	20	4.49	500	2.81	34.35	Line effect is significant
Zone 4	Lalan Uzhavoor	13	80	3.8	20	2.31	20	2.47	NS	--	30.69	
District			80	5.19	20	3.89	20	2.66	500	1.67	31.72	

Table A.7

Effect of line on grain yield of rice during Kharif & Rabi , 1978-79 at Kozhikode District
(Type A Experiment)

District	Zone	Blocks	No. of trials	N ₁₂₀ P ₆₀ K ₄₀	N ₁₂₀ P ₆₀ K ₄₀ ⁺ Lime	Effect of line	C.D.
Kozhikode (Kharif)	1	Badagara Kunnummal	6	43.66	46.82	3.16	7.26
	2	Balussery Perambra	7	28.61	32.55	3.94	5.06
	3.	S.Battery	8	58.15	58.34	0.19	6.06
	4	Chevayoor Kozhikode	9	43.27	43.87	0.60	7.33
District average			30	43.89	45.68	1.78	3.28
Kozhikode (Rabi)	1	Badagara Kunnummal	10	36.93	37.59	0.66	4.47
	2	Balussery	11	36.02	35.58	-0.44	3.77
	3	S.Battery	2	43.51	43.88	0.37	3.83
	4	Chevayoor Kozhikode	11	32.05	35.44	3.39	3.72
District average			34	44.52	46.19	1.67	1.53

Table A.8

36

Effect of line on grain yield of rice during Kharif and Rabi, 1978-79 at Kottayam District
(Type 4 Expt.)

District	Zone	Block	No. of trials	N ₁₂₀ P ₆₀ K ₄₀	N ₁₂₀ P ₆₀ K ₄₀ & Line	Effect of line	C.D.
Kottayam (Kharif)	1	Vaikkom	10	58.92	59.82	0.90	5.16
	2	Pallan	9	35.74	41.96	6.12*	4.32
	3	Madappally I Madappally II	9	47.65	50.63	2.98	3.27
	4	Lalan Uzhavoor	9	46.69	45.65	1.04	5.44
District average				47.57	49.77	2.20	2.31
Kottayam (Rabi)	1	Vaikkom Kaduthuruthy	12	36.19	36.37	0.18	2.81
	2	Pallan	6	48.82	51.11	2.29	6.70
	3	Madappally I Madappally II	14	54.25	57.06	2.81*	2.58
	4	Lalan Uzhavoor	13	39.73	41.28	1.55	2.19
District Average				44.52	46.19	1.67	1.53

800826

Chart A.1

ZONALWISE VARIATION IN N RESPONSE IN KOZHIKODE DISTRICT
DURING KHARIF 1978-79 (TYPE -A)

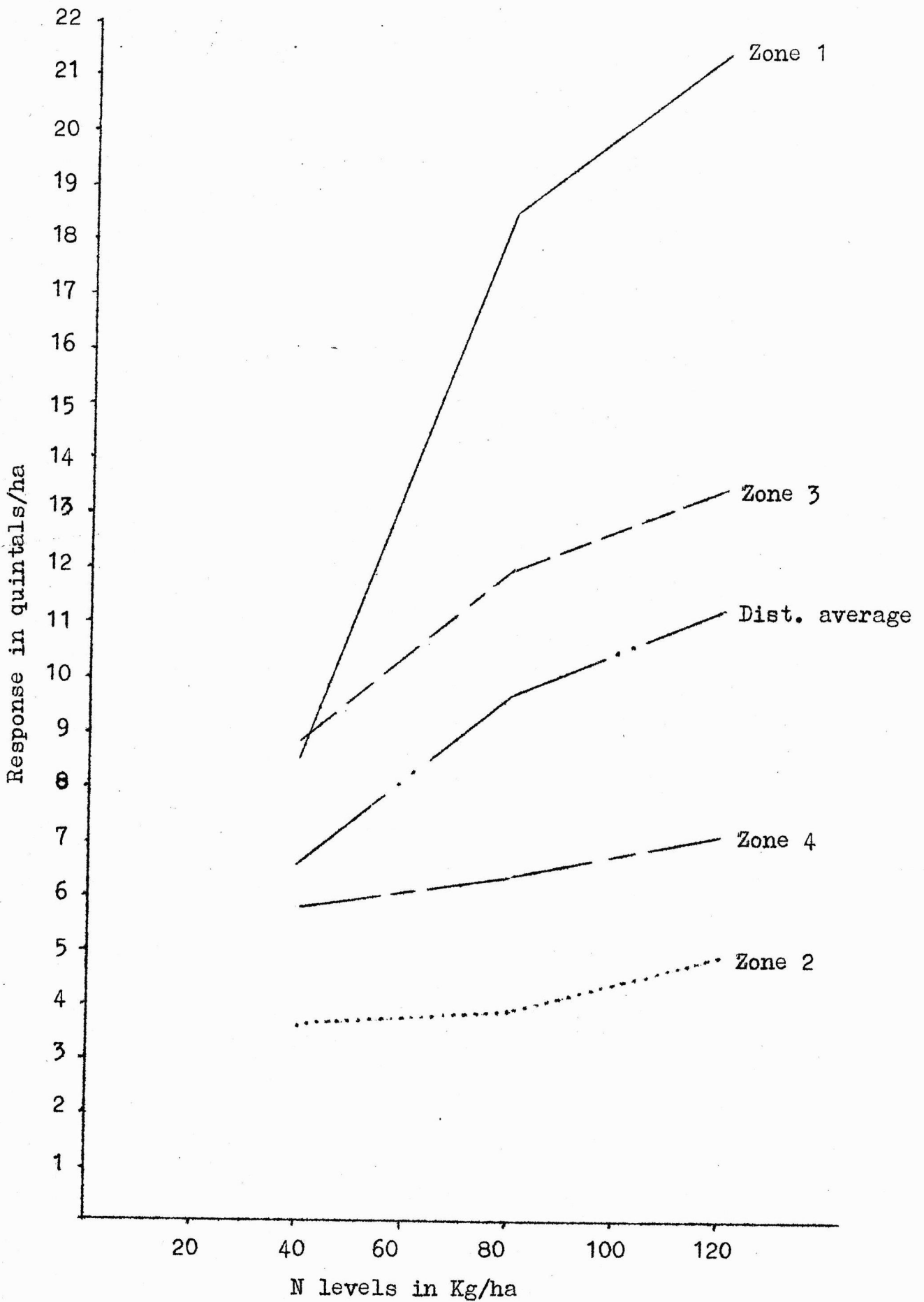


Chart A.2

ZONALWISE VARIATION IN N RESPONSE IN KOZHIKODE DISTRICT
DURING RABI 1978-79 (TYPE -A)

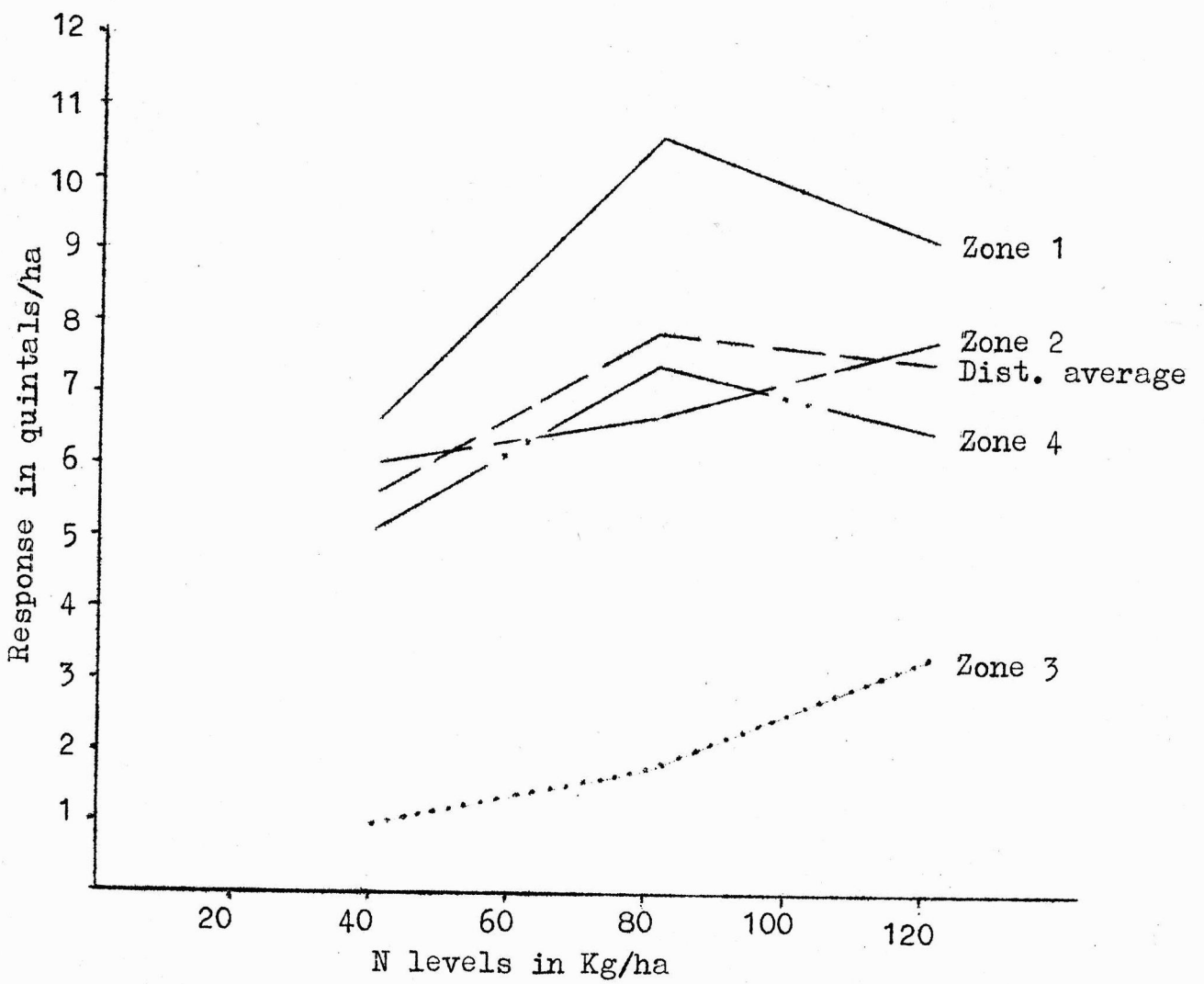


Chart A.3

DISTRICTWISE VARIATION IN N RESPONSE DURING KHARIF
AND RABI SEASONS 1978-79 (TYPE-A)

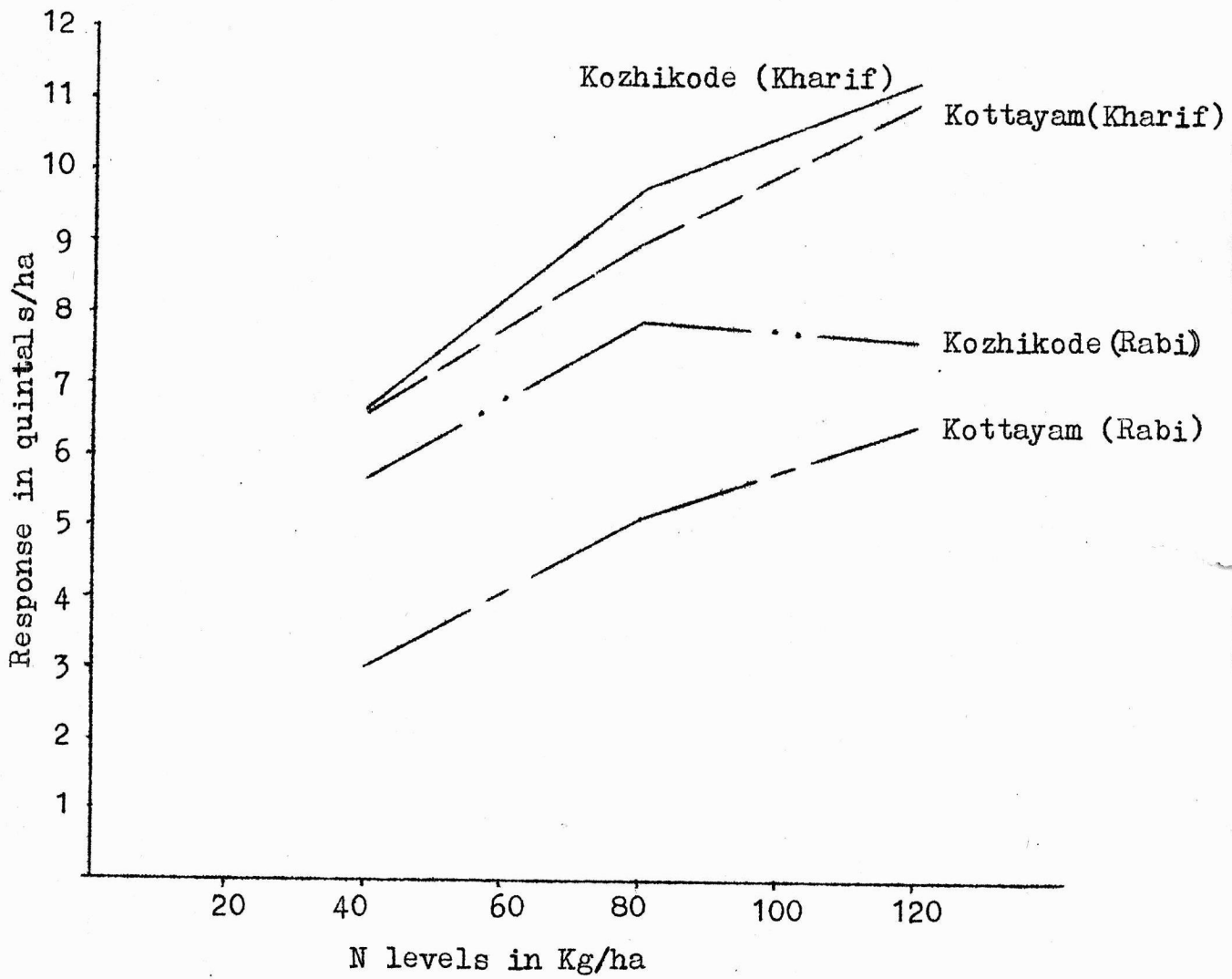


Chart A.4

ZONALWISE VARIATION IN N RESPONSE IN KOTTAYAM DISTRICT
DURING KHARIF 1978-79 (TYPE -A)

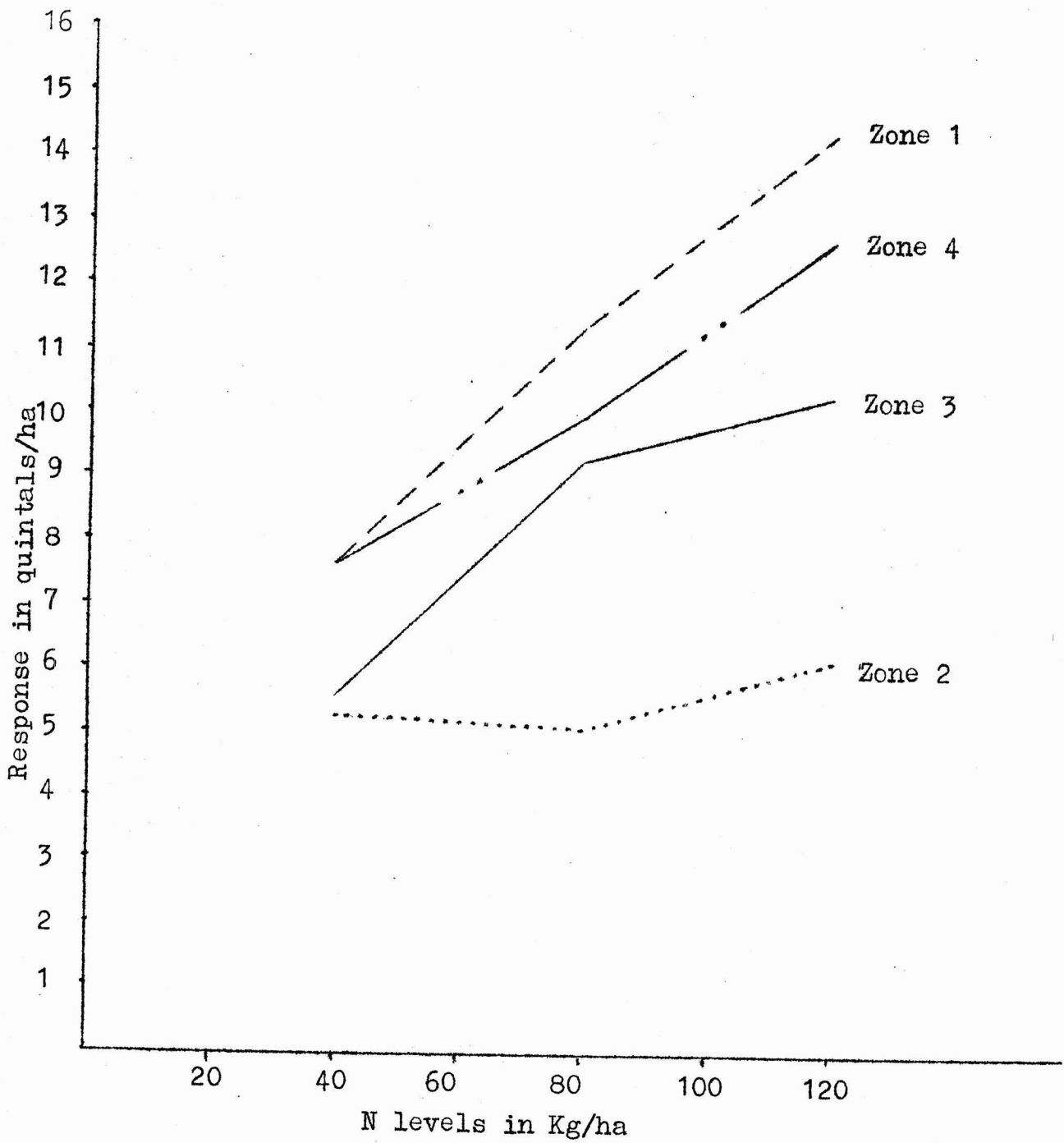


Chart A.5

ZONAL VARIATION IN N RESPONSE IN KOTTAYAM DISTRICT
DURING RABI 1978-79 (TYPE -A)

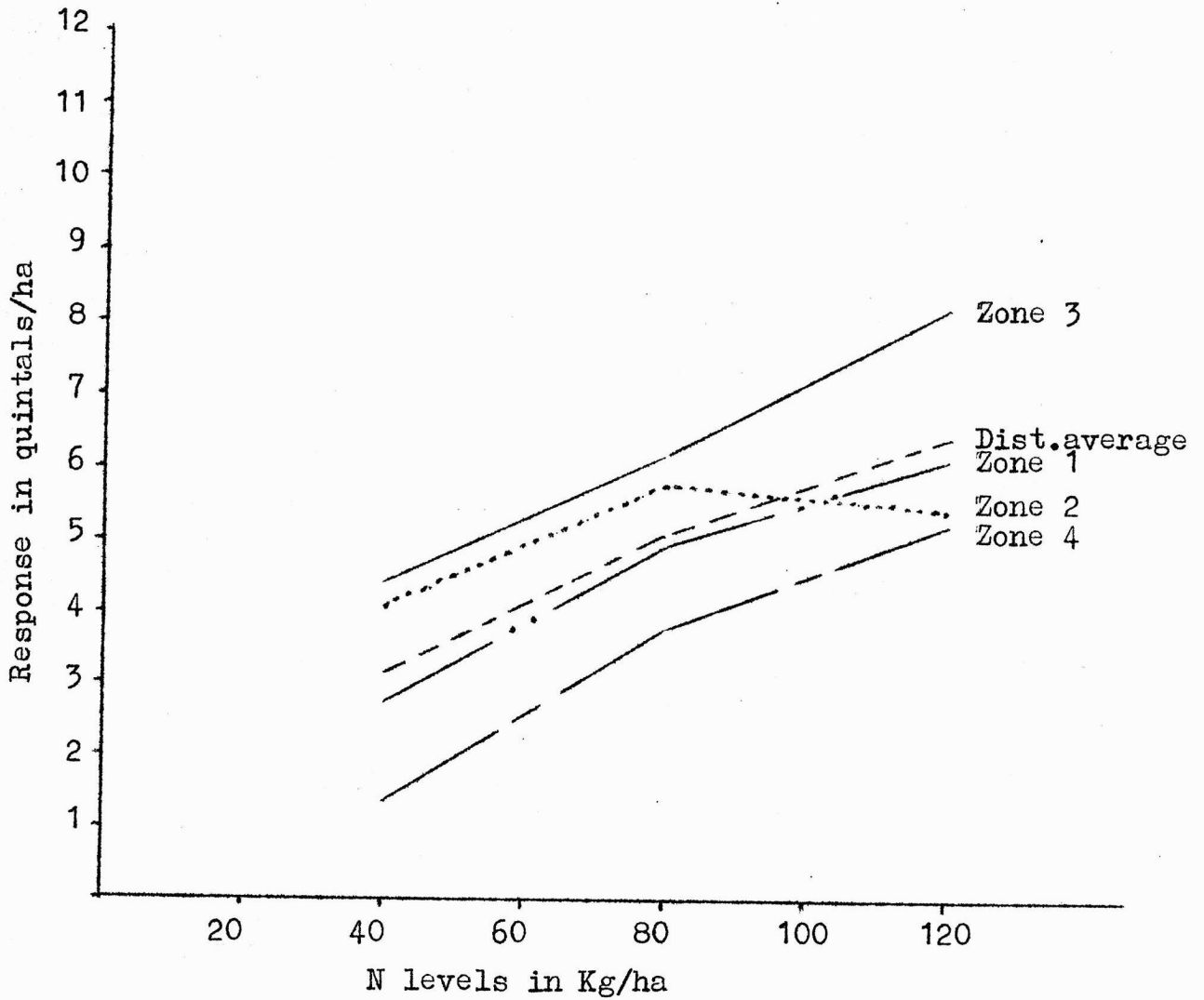


Chart A.6

ZONALWISE VARIATION IN P RESPONSE AND K RESPONSE IN KOZHIKODE DISTRICT
DURING RABI 1978-79 (TYPE -A)

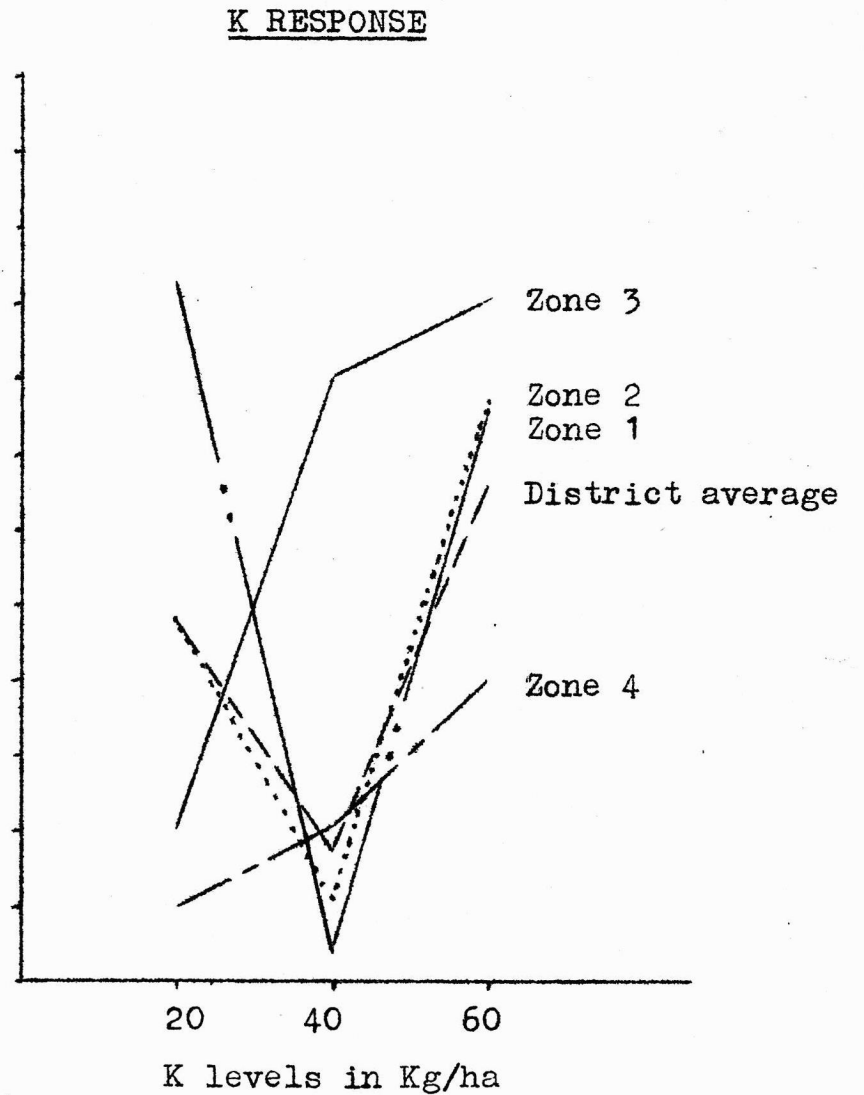
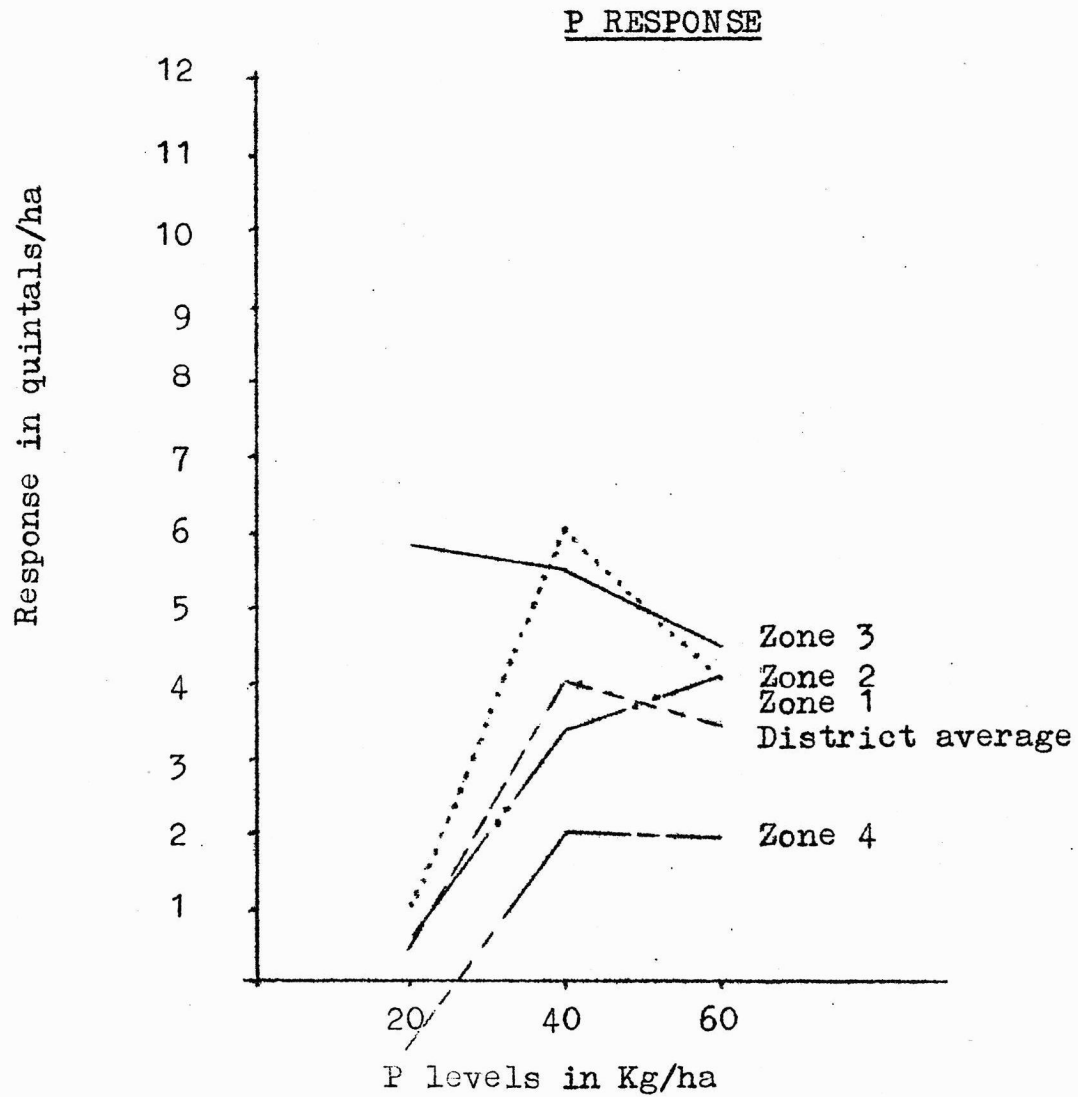


Chart A.7

ZONALWISE VARIATION IN K RESPONSE IN
KOTTAYAM DISTRICT DURING KHARIF 1978-79
(TYPE -A)

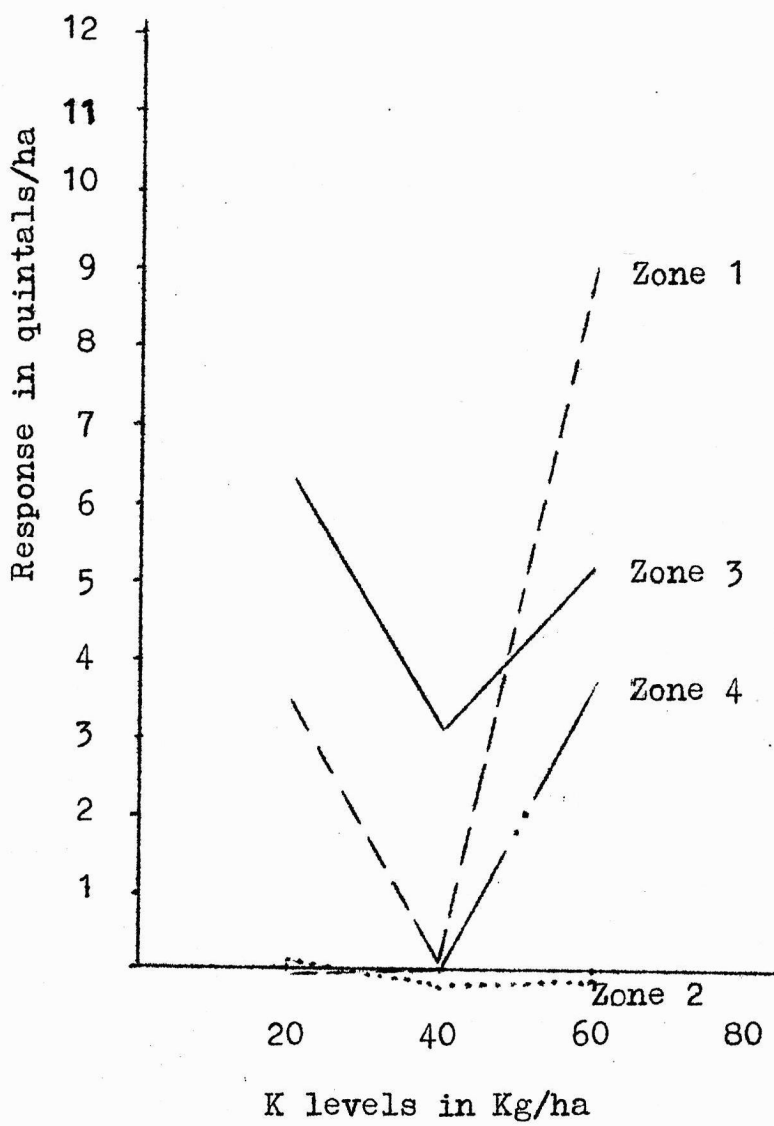
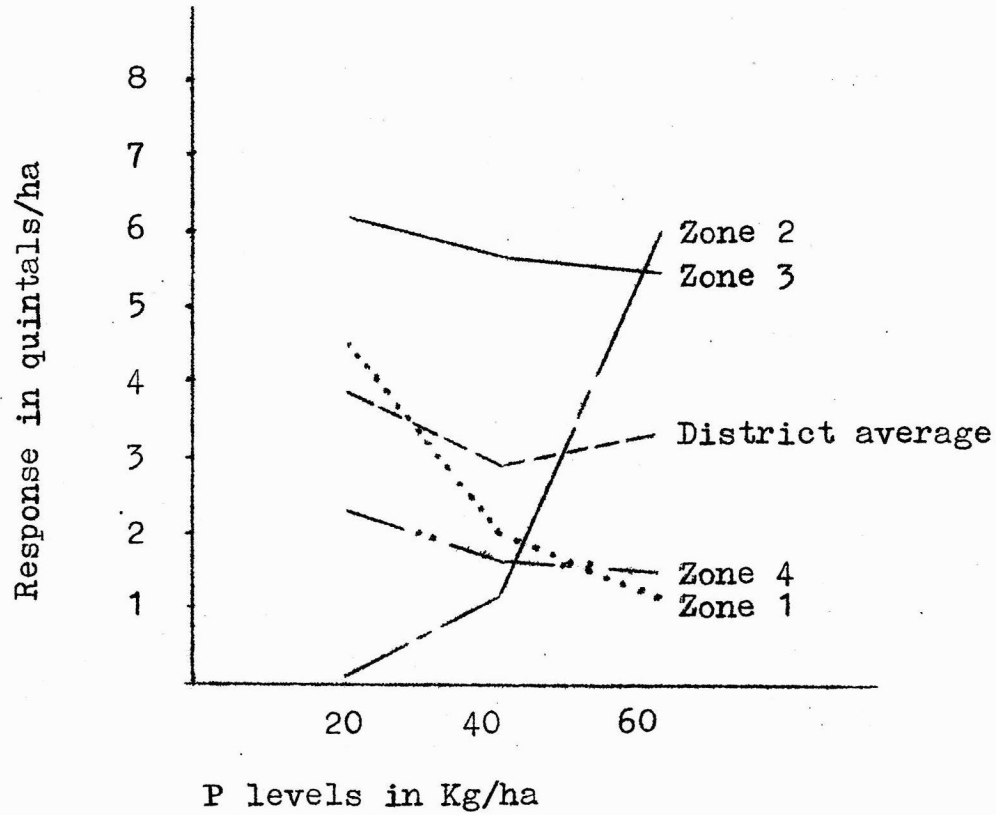


Chart A.8

ZONAL VARIATION IN P RESPONSE
IN KOTTAYAM DISTRICT DURING
RABI 1978-79 (TYPE -A)



ZONAL VARIATION IN K RESPONSE
IN KOTTAYAM DISTRICT DURING
RABI 1978-79 (TYPE -A)

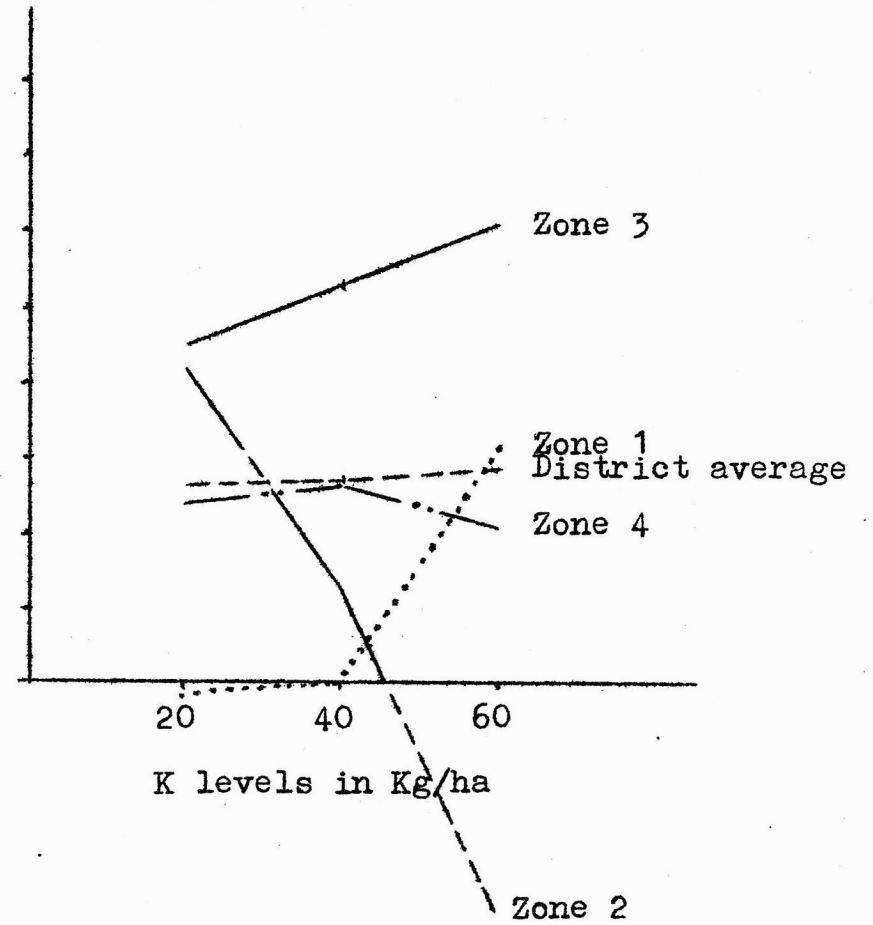


Chart A.9

DISTRICTWISE AND SEASONWISE VARIATION IN P RESPONSE AND K RESPONSE

P RESPONSE

K RESPONSE

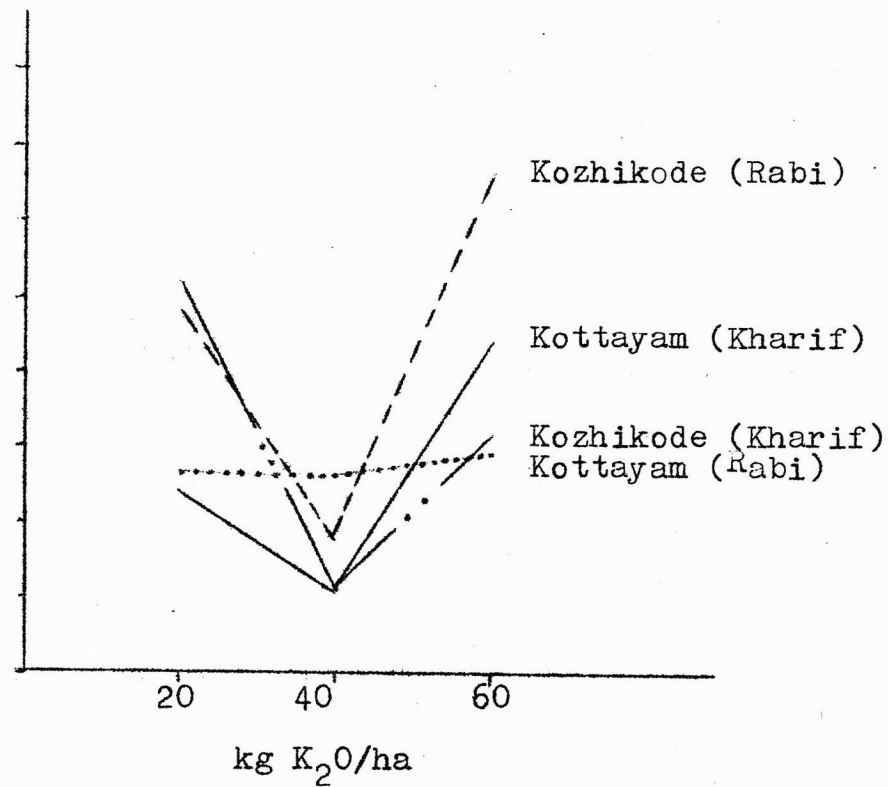
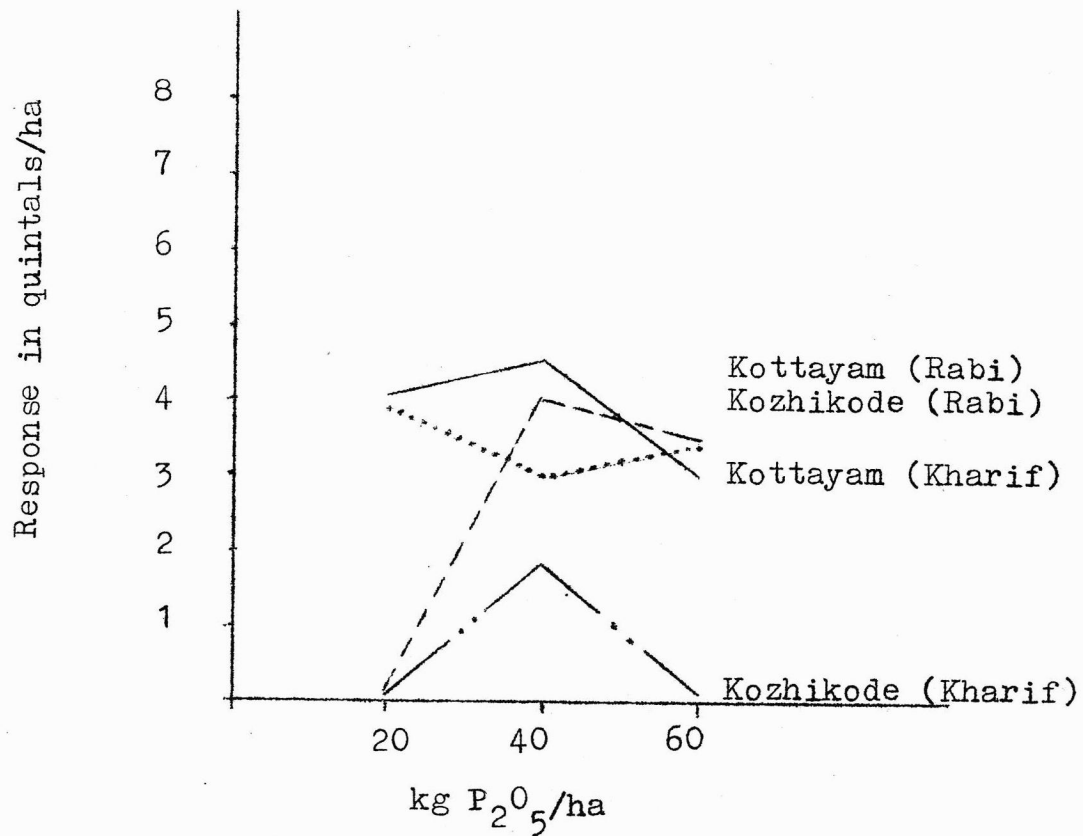


Chart A-10

SEASONWISE VARIATION IN YIELD OF RICE IN KOZHIKODE DISTRICT (VARIETY - JAYA)

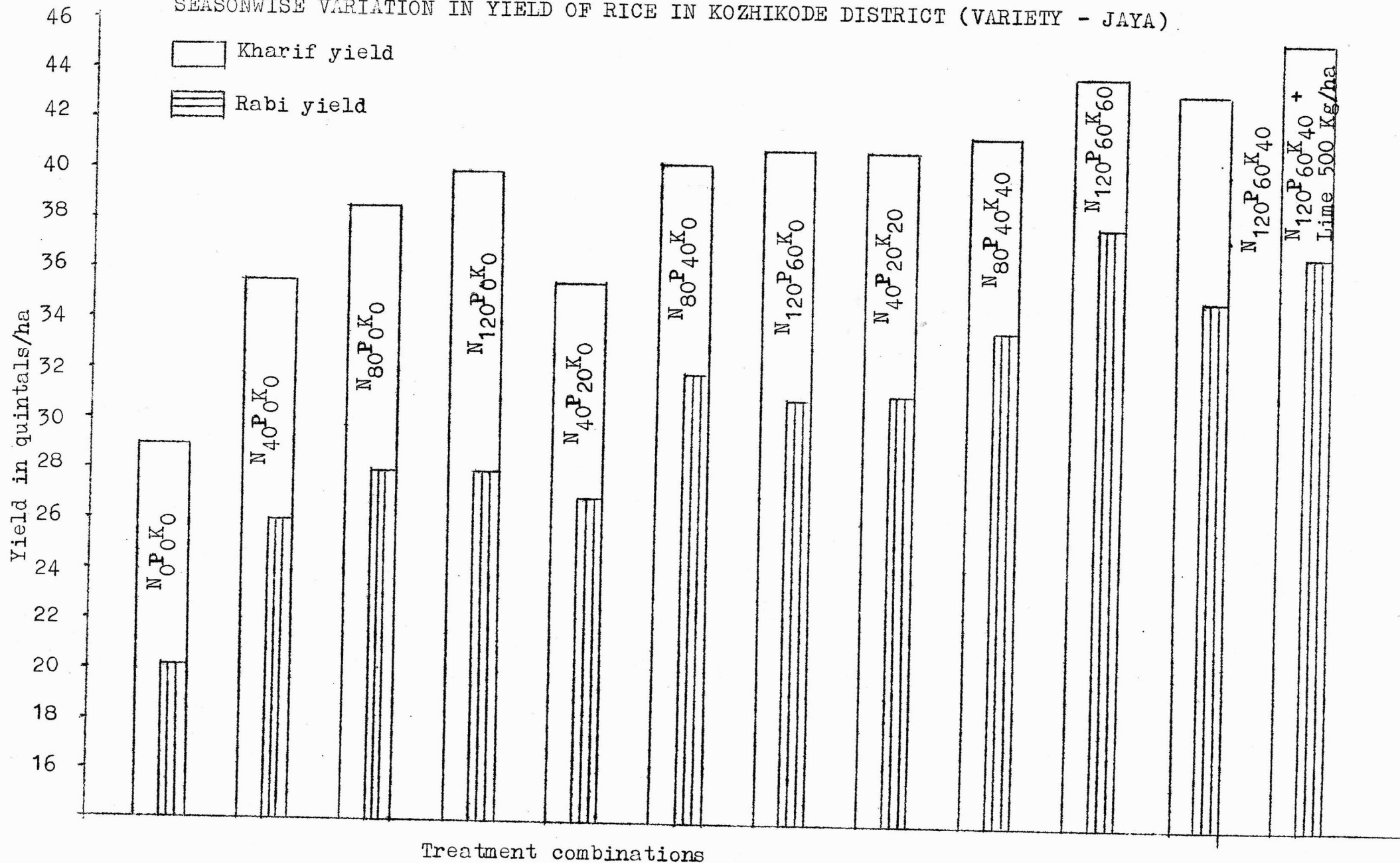
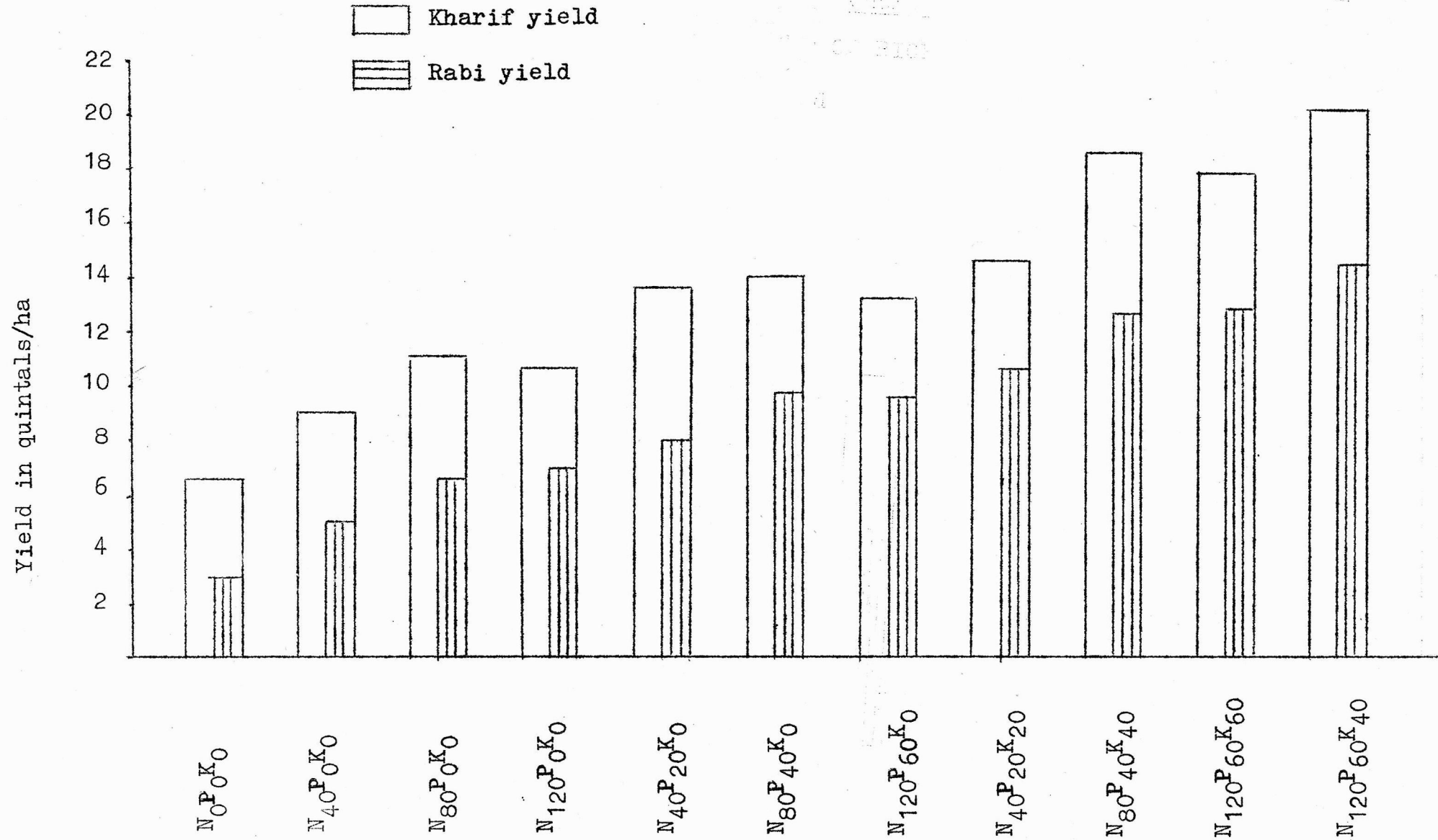


Chart A.11

SEASONWISE VARIATION IN YIELD OF RICE IN KOTTAYAM DISTRICT (Variety : Jaya)



A total of 127 experiments had been successfully conducted and the results analysed. The response of the different varieties with reference to different N levels have been depicted in Tables B.1 and B.2 and Charts B.1 and B.2.

Kozhikode District

It has been observed that the varieties Triveni and IR-36 give significant response to nitrogen even upto 120 kg and there is no significant difference between these two varieties at any of the levels tried. But the total yield is more with IR-36 variety though the difference is not significant (refer Chart B.1 and Table B.1). This shows that the pre-release variety IR-36 is equally good or even better than the standard variety Triveni. However the yield of the control plots (no nitrogen) also shows that IR-36 is significantly superior to Triveni during Kharif since the former gives an yield of 33.80 q/ha, compared to 30.45 q/ha of the latter. The recommended dose of N for each zone and for the district has been given in Table B.3. This shows that in general nitrogen can be applied even upto 120 kg for getting maximum yield in respect of both the varieties during Kharif, except in zone 3 where the suggested dose is 40 kg.

During Rabi, both the varieties show the same trend as that of Kharif season. There is no significant difference between the varieties also (Table B.2). The best dose of N is found to be 120 kg N/ha in all the zones for both the varieties except for IR-36 in zone 3, where 80 kg N/ha is found to be the best dose (Table B.4). The response of nitrogen according to the different doses are depicted in Charts B.1 and B.2. For the district as a whole, the best dose is found to be 120 kg N/ha for both the varieties.

Kottayam District

During Kharif, significant response is observed for all the N levels in all the zones except in zone 4 in respect of Triveni. IR-36 performs better than Triveni. The difference

between these two varieties are significant in respect of all the three levels of nitrogen, and the increase in responses are 2.0 q., 3.91 and 1.86 q/ha (refer Table B.1) respectively. For zones 1 and 3, the best dose of N is found to be 120 kg/ha for Triveni and 80 kg for IR-36. In respect of zone 2, Triveni variety responded favourably only upto 80 kg N level whereas IR-36 responded upto 120 kg N/ha. No increase is seen for Triveni in zone 4 whereas the response for IR-36 is 80 kg. The general recommendation for the whole district is 120 kg N/ha for both the varieties (Table B.5). But IR-36 performs better than Triveni during Kharif season.

During Rabi, the pre release variety tested is culture 1907 and it shows higher response at lower levels of N i.e. 40 and 80 kg in zone 1 and 2 respectively. For Triveni the response is significant in all the zones at all the three levels of nitrogen, whereas in respect of C-1907, the response is not significant for all the 3 levels in zone 4. However, the general trend shows that the C.1907 is as good as Triveni in Kottayam district and the pooled analysis for the district also revealed that C.1907 is the best variety for Rabi season (refer Table B.6 and Chart B.2). Excepting in zone 4 the medium short duration variety Triveni responded upto 120 kg N in all blocks. The recommended doses of N for C.1907 variety for zones 1, 2 and 3 are 40 kg, 80 kg and 120 kg respectively. In the case of zone 4 no response in grain yield is noticed even with 40 kg N. The general recommendation for the whole district is 120 kg N/ha for both the varieties.

Table B.1

Effect of N fertilization on pre release rice varieties during Kharif 1978-79
(Type B1 Experiment)

Dis- trict	Zone	Blocks	No. of trials	Triveni			IR-36				CD 5%	
				Control yield	N ₄₀ (Response over control in a ha)	N ₈₀	N ₁₂₀	Control yield	N ₄₀ (Response over control in a ha)	N ₈₀		N ₁₂₀
Kozhi- kode	1	Badagara Kunnummal	4	31.08	8.77	11.79	19.25*	33.88	6.73	9.28	14.74*	14.34
	2	Balussery Peranbra	7	23.57	4.56	2.53	6.63*	26.32	2.85	6.18*	5.24*	4.82
	3.	S. Battery	9	35.72	7.28*	6.55*	8.70*	38.37	8.00*	7.83*	11.62*	5.96
	4	Chevayoor Kozhikode	9	30.26	6.56*	8.20*	13.69*	35.02	3.24	8.59*	11.99*	5.71
District			29	30.45	6.60*	6.81*	11.21*	33.80	5.10*	7.87*	10.63*	3.19
Kottayam	1	Vaikkom Kaduthuruthy	10	37.37	5.73*	8.48*	14.94*	39.94	8.90*	15.03*	14.73*	3.99
	2	Pallam	9	27.08	2.69	4.63*	7.59*	27.46	1.34	4.79*	8.40*	3.05
	3	Madappally-I Madappally-II	8	25.79	3.20*	6.89*	11.88*	26.13	6.31*	10.86*	12.85*	2.49
	4	Lalam Uzhavoor	7	30.01	0.71	1.18	0.32	36.96	4.55	6.08*	7.53*	4.80
District			34	30.41	3.30*	5.58*	9.27*	32.77	5.39*	9.49*	11.13*	1.78

Table B.2

Effect of N fertilization on pre release rice varieties during Rabi 1978-79
(Type B1 Experiment)

District	Zone	Blocks	No. of trials	Triveni			IR-36			CD 5%		
				Control yield	N ₄₀ (response over control)	N ₈₀	N ₁₂₀	Control yield	N ₄₀ (Response over control)		N ₈₀	N ₁₂₀
Kozhikode	1	Badagara Kunnammal	10	24.79	8.74*	18.73*	28.49*	29.06	8.58*	20.52*	29.11*	6.17
	2	Balusseri Peranbra	12	22.50	1.79	5.23*	7.72	26.63	1.81*	4.06*	8.10*	2.07
	3	S. Battery	4	31.88	5.26*	8.02*	11.75*	34.67	3.88*	6.40*	9.41*	3.32
	4	Chevayoor Kozhikode	9	25.32	1.97	7.10*	14.31*	24.92	3.36	5.12*	11.47*	4.84
District			35	24.95	4.22*	9.89*	15.81*	27.80	4.39*	9.30*	15.12*	2.25
Kottayam	1	Vaikom Kaduthuruthy	10	25.98	4.09*	4.12*	10.61*	25.18	10.18*	11.74*	11.85*	3.03
	2	Pallam	7	36.96	4.73*	6.46*	9.77*	39.09	2.41	5.27*	7.03*	3.55
	3	Madappally-I Madappally-II	6	34.68	3.98*	7.07*	11.08*	35.55	4.45*	8.04*	11.99*	1.22
	4	Lalam Uzhavoor	6	28.04	4.28*	3.96*	6.35*	35.26	2.82	2.61	1.74	3.10
District			29	30.80	4.26*	5.26*	9.62*	32.77	5.60*	7.52*	8.62*	1.49

Table B.3

Results of experiments conducted at Kozhikode District during Kharif 1978-79
Type B Varieties: Triveni and IR-36.

41

Zone	Blocks	No. of trials	Varieties	Best dose of N and increase in grain yield (q/ha)	Control average (q/ha)	Variety average (q/ha)	Best variety	Remarks
Zone 1	Badagara Kunnummal	4	Triveni	120 kg N/ha (19.25)	31.08	41.03	Both are alike	
			IR-36	120 kg N/ha (14.74)	33.88	41.57		
Zone 2	Balussery Peranbra	7	Triveni	120 kg N/ha (6.63)	23.57	27.00	Both are alike	
			IR-36	80 kg N/ha (6.18)	26.32	29.00		
Zone 3	S.Battery	9	Triveni	40 kg N/ha (7.28)	35.72	41.35	IR-36	
			IR-36	40 kg N/ha (8.00)	38.37	45.23		
Zone 4	Chevayoor Kozhikode	9	Triveni	120 kg N/ha (13.69)	30.26	37.38	Both are alike	
			IR-36	180 kg N/ha (8.59)	35.02	40.97		
District		29	Triveni	120 kg N/ha (11.21)	30.45	36.61	IR-36	
			IR-36	120 kg N/ha (10.63)	33.80	39.70		

Table B4

Results of experiments conducted at Kozhikode District during Rabi 1978-79.

Type B1 : Varieties : Thriveni and IR-36.

Zone	Blocks	Varieties	No.	Best dose of N of and increase in trials grain yield (kg/ha)	Control Variety average (Basal P ₆₀ K ₆₀)	Best average variety	Response over P ₆₀ K ₆₀			CD 5%	
							N ₄₀	N ₈₀	N ₁₂₀		
1	Badagara Kunnummal	Thriveni IR-36	10	120 kg N/ha (28.49)	24.79	38.78	Both are alike	8.74	18.73	28.49	6.17
				120 kg N/ha (29.11)	29.06	43.62		8.58	20.52	29.11	6.17
2	Balussery Perambra	Triveni IR-36	12	120 kg N/ha (7.72)	22.50	26.18	IR-36	1.79	5.23	7.72	2.07
				120 kg N/ha (8.10)	26.63	30.12		1.81	4.06	8.10	2.07
3	S.Battery	Triveni IR-36	4	120 kg N/ha (11.75)	31.88	38.14	Both are alike	5.26	8.02	11.75	3.82
				80 kg N/ha (6.40)	34.67	39.62		3.98	6.40	9.41	3.32
4	Chevayoor Kozhikode	Triveni	9	120 kg N/ha (14.31)	25.32	31.16	Both are alike	1.97	7.10	14.31	4.84
				120 kg N/ha (11.47)	24.92	29.91		3.36	5.12	11.47	4.84
District	Triveni IR-36	35	120 kg N/ha (15.81)	24.95	32.43	IR-36	4.22	8.89	15.81	2.25	
			120 kg N/ha (15.12)	27.80	35.80		4.39	9.30	15.12	2.25	

Table B-5

Results of experiments conducted at Kottayam District during Kharif 1978-79

Type : Variety : Triveni and IR-36.

Zone	Blocks	No. of trials	Varieties	Best dose of N and increase in grain yield (q/ha)	Control average (q/ha)	Variety average (q/ha)	Best variety	Remarks
Zone 1	Vaikom Kaduthuruthy	10	Triveni IR-36	120 kg N/ha (14.94) 80 kg N/ha (15.03)	37.37 39.94	44.65 49.60	Both are alike	
Zone 2	Pallam	9	Triveni IR-36	80 kg N/ha (4.63) 120 kg N/ha (8.40)	27.08 27.46	30.81 31.10	Both are alike	
Zone 3	Madappally -I Madappally-II	8	Triveni IR-36	120 kg N/ha (11.88) 80 kg N/ha (10.86)	25.79 26.13	31.29 33.63	IR-36	
Zone 4	Lalam Uzhavoor	7	Triveni IR-36	NS 80 kg N/ha (6.08)	30.01 36.96	30.56 41.49	IR-36	
District			Triveni IR-36	120 kg N/ha (9.27) 120 kg N/ha (11.13)	30.41 32.77	34.94 39.28	IR-36	

Table B-6

Results of experiments conducted at Kottayam District during Rabi 1978-79.
 Type B : Varieties : Triveni & Culture 1907.

Zone	Blocks	Varieties	No. of trials	Best dose of N and increase in grain yield (kg/ha)	Control average (basal P ₆₀ K ₆₀)	Variety average	Best variety	Remarks
Zone 1	Vaikom Kaduthuruthy	Triveni C.1907	10	120 kg N/ha (10.61)	25.98	30.69	C.1907	
				40 kg N/ha (10.18)	25.18	33.63		
Zone 2	Pallam	Triveni C.1907	7	120 kg N/ha (9.77)	36.96	42.20	Both are alike	
				80 kg N/ha (5.27)	39.09	42.77		
Zone 3	Madappally-I Madappally-II	Triveni C.1907	6	120 kg N/ha (11.08)	34.69	40.22	Both are alike	
				120 kg N/ha (11.99)	35.55	41.67		
Zone 4	Lalam Uzhavoor	Triveni C.1907	6	40 kg N/ha (4.28)	28.04	31.68	Both are alike	
				NS	35.26	37.05		
District		Triveni C.1907	29	120 kg N/ha (9.62)	30.86	35.64	C.1907	
				120 kg N/ha (8.62)	32.77	38.21		

Chart B.1

EFFECT OF N FERTILIZATION ON TRIVENI AND IR-36 DURING KHARIF 1978-79 IN KOZHIKODE AND KOTTAYAM DISTRICTS (TYPE B₁)

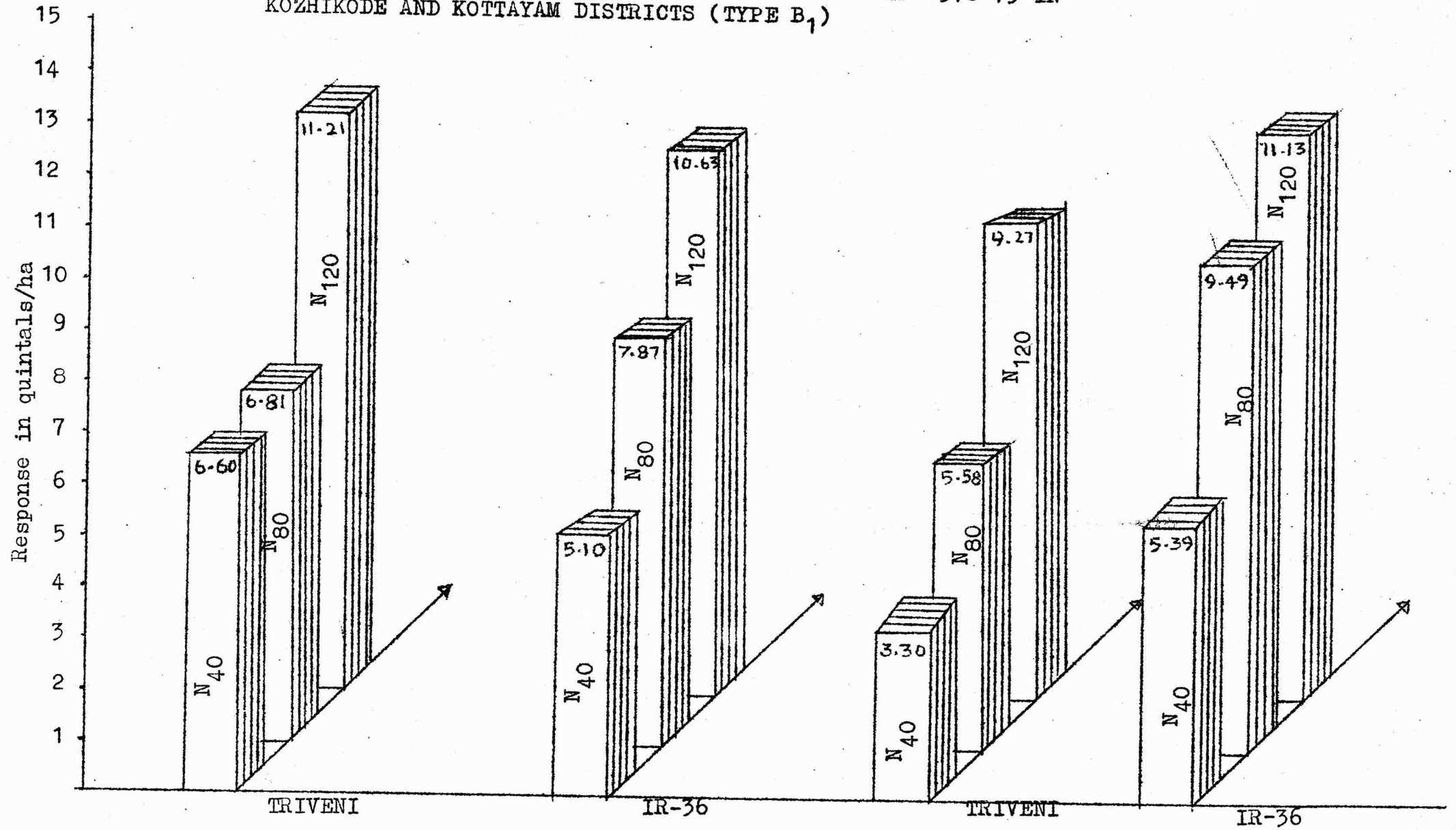
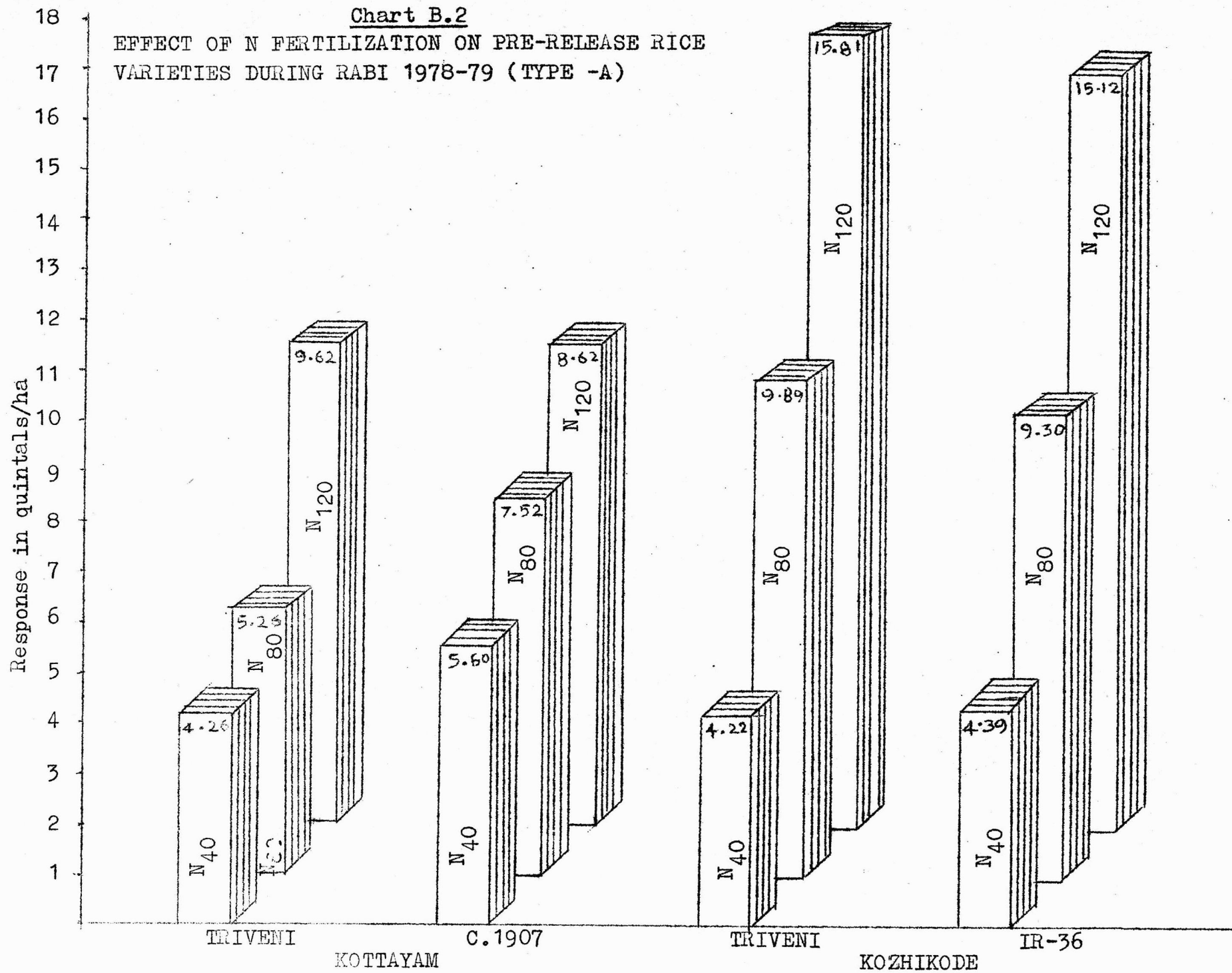


Chart B.2

EFFECT OF N FERTILIZATION ON PRE-RELEASE RICE VARIETIES DURING RABI 1978-79 (TYPE -A)



TYPE G. EXPERIMENT

Under the above experiment a total number of 34 trials have been successfully conducted and analysed. In order to pin point the actual fertilizer schedule under resource constraints, the responses and income per rupee investment in fertilizers were calculated in respect of each of the treatments separately for Kharif and Rabi and also total cost and returns for the year in respect of the zones as well as for the district as a whole. The results are summarised in tables G.1 to G.8.

Kozhikode District

Here the experiment was successful only in zones 2 and 4. The table G.1 shows that in zone 2, Balussery and Perambra blocks the maximum economic yield was obtained for the treatment combination of $N_{90} P_{90} K_0$ in Kharif and $N_{90} P_0 K_{90}$ in Rabi with an income of Rs.2.47 and Rs.2.75/Re investment in fertilizers respectively. For the year the total yield and the out-turn in Re/Re investment were 55.59 q/ha and Rs.2.59 respectively. This reveals that in zone 2 application of potassium can be skipped during Kharif and phosphorus during Rabi, provided that the nutrients are applied at 90 kg/ha during all seasons. However in both the seasons, nitrogen need be applied at 90 kg/ha. for getting maximum grain yield as well as net profit in the case of the popular variety Jaya.

In zone 4, i.e. Chevayoor and Kozhikode blocks, maximum economic yield is obtained for the treatment combination of $N_{60} P_0 K_{30}$ in Kharif and $N_{60} P_{60} K_0$ in Rabi. The yield and the returns for the two seasons together were 68.58 q/ha and Rs.2.43/Re investment in fertilizers in respect of treatment 8 (Table G.2). This reveals that in zone 4, application of phosphorus can be skipped in Kharif and potassium in Rabi for getting maximum profitable production of Jaya variety. The level of K can be reduced to 30 kg in Kharif and that of P to 60 kg/ha during Rabi. Here nitrogen need be applied only at 60 kg/ha. in both the seasons.

The result of the pooled analysis for the above two zones shows that for the district maximum profitable yield is obtained with the treatment combination of $N_{60}P_{60}K_0$ in Kharif and $N_{60}P_{60}K_0$ in Kharif and $N_{90}P_{45}K_{45}$ in Rabi (Table G.3). The total yield is 62.45 q/ha with an income of Rs.2/Re investment in fertilizers.

Kottayam District

Here in all the four zones, the trials are successful. In zone 1, i.e. Vaikom and Kaduthuruthy blocks, maximum profitable yield is obtained for the treatment combination of $N_{60}P_{30}K_{30}$ in both the seasons. The response is comparatively high and a return of Rs.6.57/Re investment in fertilizers was obtained during Kharif. During Rabi it was only Rs.2.76. Even though the total yield for the year is maximum in respect of the treatment T_2 i.e. $N_{120}P_{60}K_{60}$ maximum profitable yield of 88.54 q/ha is obtained in respect of T_9 (i.e. $N_{60}P_{30}K_{30}$) with a return of Rs.4.59/Re investment in fertilizers (Table G.4). This reveals that the zone 1 responds well towards the balanced fertilizer application in the ratio of 60:30:30 in both the seasons.

In zone 2 Pallam block the result is similar to that of zone 1. Application of $N_{60}P_{30}K_{30}$ during both the seasons, gives maximum economic yield of 91.55 q/ha, with an income of Rs.3.53/Re investment in fertilizers (Table G.5).

In zone 3 Madappally I and II blocks maximum economic yield is obtained in respect of the treatments $N_{60}P_0K_0$ in Kharif and $N_{60}P_{30}K_{30}$ in Rabi. The out-turn is as high as Rs.7.32 in Kharif and Rs.4.69 in Rabi per rupee investment in fertilizers. The total yield for the year is 89.28 q/ha. This gives a return of Rs.5.79/Re investment in fertilizers (Table G.6). This shows that in this particular zone even without applying phosphorus and potassium, in Kharif season, maximum profitable yield could be obtained. However, during Rabi, a balanced application of fertilizers in the ratio 60:30:30 need only be applied for getting maximum economic returns.

In zone 4 Lalam and Uzhavoor blocks also the result is very similar to that of zone 1 and 2. Balanced application of N,P,K in the ratio 60:30:30 gives the maximum profitable yield. A total yield of 81.11 q/ha is obtained for the year with a return of Rs.3.33/rupee investment in fertilizers (Table G.7).

The result of the pooled analysis of the above four zones of the Kottayam district shows that the maximum profitable yield of 87.36 q/ha for the year is obtained in respect of the treatment $N_{60}P_{30}K_{30}$ with an income of Rs.4.11/Re investment in fertilizers (Table G.8). This shows that for the district as a whole a balanced application of NPK in the ratio of 60:30:30 is to be applied in both the seasons for getting maximum returns.

Table G1

Results of G-type experiments conducted during 1978-79 in Kozhikode District (Increase yield of grain in q/ha, Nutrient dose in kg/ha)

Zone 2. Quilandy : Variety : Jaya.

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers (in Rs)	Returns per Re. investment on fertili- zer (Rs)	Treatments Rabi	Yield	Increase over con- trol	Cost of fer- tilizers (in Rs)	Returns per Re investment in fertili- zers (Rs)	Total cost for the year (in Rs)	Total yield for the year	Increase over control	Returns per Re. invest- ment in fer- tilizers (Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	15.34	-	-	-	N ₀ P ₀ K ₀	15.02	-	-	-	-	30.36	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	21.60	6.26	809	0.96	N ₁₂₀ P ₆₀ K ₆₀	31.13	16.11	809	2.48	1618	52.73	22.37	1.72
T ₃ -N ₉₀ P ₄₅ K ₄₅	20.34	5.00	607	1.02	N ₁₂₀ P ₆₀ K ₆₀	27.55	12.53	809	1.93	1416	47.89	17.52	1.54
T ₄ -N ₉₀ P ₉₀ K ₀	28.68	13.34	673	2.47*	N ₉₀ P ₀ K ₉₀	26.92	11.90	540	2.75*	1213	55.59	25.23	2.59*
T ₅ -N ₉₀ P ₀ K ₉₀	18.20	2.86	540	0.66	N ₉₀ P ₉₀ K ₀	18.00	2.98	673	0.55	1213	36.21	5.84	0.60
T ₆ -N ₆₀ P ₃₀ K ₃₀	22.50	7.16	404	2.21	N ₉₀ P ₉₀ K ₀	24.88	9.86	673	1.83	1077	47.38	17.02	1.97
T ₇ -N ₆₀ P ₆₀ K ₀	22.17	6.83	449	1.90	N ₉₀ P ₄₅ K ₄₅	20.47	5.45	607	1.12	1056	42.64	12.28	1.45
T ₈ -N ₆₀ P ₀ K ₃₀	18.96	3.62	319	1.41	N ₆₀ P ₆₀ K ₀	17.78	2.76	449	0.76	768	36.73	6.37	1.03
T ₉ -N ₆₀ P ₃₀ K ₃₀	21.99	6.65	404	2.05	N ₆₀ P ₃₀ K ₃₀	17.85	2.83	404	0.87	808	39.85	9.48	1.46
T ₁₀ -N ₆₀ P ₀ K ₀	18.39	3.05	278	1.37	N ₆₀ P ₃₀ K ₃₀	18.36	3.34	404	1.03	682	36.76	6.39	1.17

Cost worked @ N - Rs.4.63/kg, P₂O₅ - Rs.2.85/kg, K₂O - Rs.1.37/kg. Grains - Rs.1.25/kg.

Table G.2

Results of G-type experiments conducted during 1978-79 in Kozhikode District
(Increase in yield of grain in q/ha, Nutrient dose in kg/ha)

Zone-4. Variety: Jaya.

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers (in Rs)	Returns per Re invest- ment in fer- tilizers(Rs)	Treatments Rabi	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re invest- ment in fer- tilizers(Rs)	Total cost for the year	Total yield for the year	Increase over control.	Returns per Re investment on fertili- zers(Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	33.44	-	-	-	N ₀ P ₀ K ₀	20.16	-	-	-	-	53.60	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	40.64	7.20	809	1.11	N ₁₂₀ P ₆₀ K ₆₀	31.74	11.58	809	1.78	1618	72.38	18.78	1.45
T ₃ -N ₉₀ P ₄₅ K ₄₅	37.83	4.39	607	0.90	N ₁₂₀ P ₆₀ K ₆₀	30.85	10.69	809	1.65	1416	68.68	15.08	1.33
T ₄ -N ₉₀ P ₉₀ K ₀	39.32	5.88	673	1.09	N ₉₀ P ₀ K ₉₀	28.22	8.06	540	1.86	1213	67.54	13.94	1.43
T ₅ -N ₉₀ P ₀ K ₉₀	28.50	-4.94	540	-1.14	N ₉₀ P ₉₀ K ₀	29.72	9.56	673	1.77	1213	58.22	4.62	0.47
T ₆ -N ₆₀ P ₃₀ K ₃₀	40.88	7.44	404	2.30	N ₉₀ P ₉₀ K ₀	31.54	11.38	673	2.11	1077	72.41	18.81	2.18
T ₇ -N ₆₀ P ₆₀ K ₀	40.43	6.99	449	1.94	N ₉₀ P ₄₅ K ₄₅	31.35	11.19	607	2.30	1056	71.78	18.17	2.15
T ₈ -N ₆₀ P ₀ K ₃₀	38.36	4.92	319	1.92	N ₆₀ P ₆₀ K ₀	30.22	10.06	449	2.80*	768	68.58	14.97	2.43*
T ₉ -N ₆₀ P ₃₀ K ₃₀	38.28	4.84	404	1.49	N ₆₀ P ₃₀ K ₃₀	26.50	6.34	404	1.96	808	64.78	11.18	1.72
T ₁₀ -N ₆₀ P ₀ K ₀	32.71	-0.73	278	-0.32	N ₆₀ P ₃₀ K ₃₀	26.92	6.76	404	2.09	682	59.63	6.03	1.10

CD = 9.73

Cost worked @ N - Rs.4.63/kg, P₂O₅ - Rs.2.85/kg, K₂O - Rs.1.37/kg. Grains - Rs.1.25/kg.

Table G.3

Results of G-Type experiments conducted during 1978-79 in Kozhikode district
(Pooled analysis) (increase in grain yield in kg/ha and nutrient dose in kg/ha)

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers (Rs)	Returns per Re invest- ment on fer- tilizers(Rs)	Treatments Rabi	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re invest- ment on fer- tilizers(Rs)	Total cost for the year	Total yield for the year	Increase over control	Returns per Re invest- ment on fer- tilizers(Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	25.18	-	-	-	N ₀ P ₀ K ₀	20.35	-	-	-	-	45.53	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	33.20	8.02	809	1.23	N ₁₂₀ P ₆₀ K ₆₀	31.64	11.29	809	1.74	1618	64.85	19.32*	1.49
T ₃ -N ₉₀ P ₄₅ K ₄₅	30.30	5.12	507	1.05	N ₁₂₀ P ₆₀ K ₆₀	29.48	9.13	809	1.41	1416	59.79	14.26	1.25
T ₄ -N ₉₀ P ₉₀ K ₀	34.60	9.42	673	1.47	N ₉₀ P ₀ K ₉₀	28.25	7.90	540	1.82	1213	62.85	17.32	1.78
T ₅ -N ₉₀ P ₀ K ₉₀	23.98	1.20	540	-0.27	N ₉₀ P ₉₀ K ₀	25.20	4.85	673	0.90	1213	49.18	3.65	0.37
T ₆ -N ₆₀ P ₃₀ K ₃₀	33.09	7.91	404	2.44	N ₉₀ P ₉₀ K ₀	29.29	8.94	673	1.66	1017	62.37	16.84*	1.95
T ₇ -N ₆₀ P ₆₀ K ₀	33.75	8.57	449	2.38*	N ₉₀ P ₄₅ K ₄₅	28.70	8.35	607	1.71	1056	62.45	16.92*	2.00*
T ₈ -N ₆₀ P ₀ K ₃₀	30.09	4.91	319	1.92	N ₆₀ P ₆₀ K ₀	25.72	5.37	449	1.49	768	55.81	10.28	1.67
T ₉ -N ₆₀ P ₃₀ K ₃₀	31.61	6.43	404	1.93	N ₆₀ P ₃₀ K ₃₀	24.30	3.95	404	1.22	808	55.91	10.38	1.60
T ₁₀ -N ₆₀ P ₀ K ₀	26.35	1.17	278	0.52	N ₆₀ P ₃₀ K ₃₀	23.86	3.51	404	1.08	682	50.21	4.68	0.85

CD = 6.74

Cost worked @ N = Rs.4.63/kg, P₂O₅ = Rs.2.85/kg, K₂O = Rs.1.37/kg. Grains = Rs.1.25/kg.

Table G.4

Results of G-Type experiments conducted during 1978-79 in Kottayam District
(Increase in yield of grain in q/ha and nutrient dose in kg/ha)

51

Zone: 1, Vaikon, Variety : Jyothi.

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re.invest- ment on fer- tilizers(Rs)	Treatments Rabi	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re.investment on ferti- lizers(Rs)	Total cost for the year	Total yield for the year	Increase over control	Returns per Re.invest- ment on fer- tilizers(Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	32.94	-	-	-	N ₀ P ₀ K ₀	25.92	-	-	-	-	58.86	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	62.95	30.01	809	4.63	N ₁₂₀ P ₆₀ K ₆₀	40.51	14.59	809	2.25	1618	103.46	44.60	3.44
T ₃ -N ₉₀ P ₄₅ K ₄₅	55.14	22.20	607	4.57	N ₁₂₀ P ₆₀ K ₆₀	36.64	10.72	809	1.65	1416	91.78	32.92	2.90
T ₄ -N ₉₀ P ₉₀ K ₀	52.73	19.79	673	3.67	N ₉₀ P ₀ K ₉₀	30.90	4.98	540	1.15	1213	83.62	24.76	2.55
T ₅ -N ₉₀ P ₀ K ₉₀	51.80	18.86	540	4.36	N ₉₀ P ₉₀ K ₀	31.84	5.92	673	1.09	1213	83.65	24.78	2.55
T ₆ -N ₆₀ P ₃₀ K ₃₀	55.63	22.69	404	7.02	N ₉₀ P ₉₀ K ₀	29.89	3.97	673	0.73	1077	85.62	26.65	3.09
T ₇ -N ₆₀ P ₆₀ K ₀	51.29	18.35	449	5.10	N ₉₀ P ₄₅ K ₄₅	31.16	5.24	607	1.07	1056	82.45	23.59	2.79
T ₈ -N ₆₀ P ₀ K ₃₀	49.59	16.65	319	6.52	N ₆₀ P ₆₀ K ₀	34.80	8.88	449	2.47	768	84.39	25.52	4.15
T ₉ -N ₆₀ P ₃₀ K ₃₀	54.19	21.25	404	6.57*	N ₆₀ P ₃₀ K ₃₀	34.85	8.93	404	2.76*	808	88.54	29.68	4.59*
T ₁₀ -N ₆₀ P ₀ K ₀	45.11	12.17	278	5.47	N ₆₀ P ₃₀ K ₃₀	32.18	6.26	404	1.93	682	77.29	18.43	3.37

CD = 5.81

Cost worked @ N= Rs.4.63/kg, P₂O₅ = Rs.2.85/kg, K₂O = Rs.1.37/kg. Grains = Rs.1.25/kg.

Table G.5

Results of G-Type experiments conducted during 1978-79 Kozhikode District
(Increase in yield of grain q/ha and nutrient dose in kg/ha)

Zone-2- Pallam, Variety: Jaya.

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re. investment on fertili- zers (Rs)	Treatments Rabi	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re. invest- ment on ferti- lizers (Rs)	Total cost for the year	Total yield for the year	Increase over control	Returns per Re. investment on fertili- zers (Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	34.60	-	-	-	N ₀ P ₀ K ₀	34.11	-	-	-	-	68.71	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	43.45	8.85	809	1.36	N ₁₂₀ P ₆₀ K ₆₀	44.19	10.08	809	1.55	1618	87.64	18.94	1.46
T ₃ -N ₉₀ P ₄₅ K ₄₅	44.27	9.67	607	1.99	N ₁₂₀ P ₆₀ K ₆₀	47.95	13.34	809	2.06	1416	92.22	23.52	2.07
T ₄ -N ₉₀ P ₉₀ K ₀	42.74	8.14	673	1.51	N ₉₀ P ₀ K ₉₀	46.50	12.39	540	2.86	1213	89.24	20.53	2.11
T ₅ -N ₉₀ P ₀ K ₉₀	45.05	10.45	540	2.41	N ₉₀ P ₉₀ K ₀	48.11	14.00	673	2.60	1213	93.16	24.46	2.51
T ₆ -N ₆₀ P ₃₀ K ₃₀	42.65	8.05	404	2.49	N ₉₀ P ₉₀ K ₀	45.04	10.93	673	2.03	1077	87.69	18.98	2.20
T ₇ -N ₆₀ P ₆₀ K ₀	42.35	7.75	449	2.15	N ₉₀ P ₄₅ K ₄₅	46.66	12.55	607	2.58	1056	89.01	20.31	2.40
T ₈ -N ₆₀ P ₀ K ₃₀	38.50	3.90	319	1.52	N ₆₀ P ₆₀ K ₀	42.92	8.81	449	2.45	768	81.42	12.72	2.07
T ₉ -N ₆₀ P ₃₀ K ₃₀	45.90	11.30	404	3.49*	N ₆₀ P ₃₀ K ₃₀	45.65	11.54	404	3.57*	808	91.55	22.84	3.53*
T ₁₀ -N ₆₀ P ₀ K ₀	39.82	5.22	278	2.34	N ₆₀ P ₃₀ K ₃₀	45.96	11.85	404	3.66	682	85.78	17.07	3.12

CD = 10.29

Cost worked @ N = Rs,4.63/kg, P₂O₅ = Rs.2.85/kg, K₂O = Rs.1.37/kg. Grains = Rs.1.25/kg.

Table G.6

Results of G-type experiments conducted during 1978-79 in Kottayam District
(increase in yield of grain in q/ha and nutrient dose in kg/ha)

53

Zone: 3 Madappally I & II. Variety : Jyothi.

Treatments Kharif	Yield	Increase over control	Cost of fertilizers (Rs)	Returns per Re.invest- ment on fer- tilizers(Rs)	Yield	Treatments Rabi	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re.investment on fertili- zers(Rs)	Total cost for the year	Total yield for the year	Increase over control	Returns per Re.investment on fertili- zers (Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	24.95	-	-	-	32.85	N ₀ P ₀ K ₀	-	-	-	-	57.80	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	40.36	15.40	809	2.37	49.28	N ₁₂₀ P ₆₀ K ₆₀	16.43	809	2.53	1618	89.63	31.83	2.45
T ₃ -N ₉₀ P ₄₅ K ₄₅	38.29	13.34	607	2.74	49.01	N ₁₂₀ P ₆₀ K ₆₀	16.16	809	2.49	1416	87.30	29.50	2.60
T ₄ -N ₉₀ P ₉₀ K ₀	37.97	13.02	673	2.41	43.87	N ₉₀ P ₀ K ₉₀	11.02	540	2.55	1213	81.84	24.04	2.47
T ₅ -N ₉₀ P ₀ K ₉₀	39.22	14.27	540	3.30	41.19	N ₉₀ P ₉₀ K ₀	8.34	673	1.55	1213	80.40	22.60	2.32
T ₆ -N ₆₀ P ₃₀ K ₃₀	38.42	13.47	404	4.16	46.51	N ₉₀ P ₉₀ K ₀	13.66	673	2.53	1077	84.93	27.13	3.14
T ₇ -N ₆₀ P ₆₀ K ₀	38.72	13.77	449	3.83	46.72	N ₉₀ P ₄₅ K ₄₅	13.87	607	2.85	1056	85.44	27.64	3.27
T ₈ -N ₆₀ P ₀ K ₃₀	38.97	14.02	319	5.49	47.55	N ₆₀ P ₆₀ K ₀	14.70	449	4.09	768	86.52	28.72	4.67
T ₉ -N ₆₀ P ₀ K ₃₀	41.11	16.16	404	5.00	48.59	N ₆₀ P ₃₀ K ₃₀	15.74	404	4.87	808	88.70	30.90	4.78
T ₁₀ -N ₆₀ P ₀ K ₀	41.25	16.30	278	7.32*	48.02	N ₆₀ P ₃₀ K ₃₀	15.17	404	4.69*	682	89.28	31.47	5.79*

CD = 6.96

Cost worked @ N = Rs.4.63/kg, P₂O₅ = Rs.2.85/kg, K₂O = Rs.1.37/kg. Grains = Rs.1.25/kg.

Table G.7

Results of G-type experiments conducted during 1978-79 in Kottayam District
(increase in yield of grain in q/ha and nutrient dose in kg/ha)

Zone-4 Lalam and Uzhavoor Blocks. Variety : Jyothi.

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re. invest- ment on ferti- lizers(Rs)	Treatments Rabi	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Re. investment on fertilizers	Total cost for the year	Total yield for the year	Increase over control	Returns per Re. Investment on fertilizers (Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	31.93	-	-	-	N ₀ P ₀ K ₀	27.55	-	-	-	-	59.58	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	45.11	13.18	809	2.03	N ₁₂₀ P ₆₀ K ₆₀	35.84	8.29	809	1.28	1618	80.95	21.37	1.65
T ₃ -N ₉₀ P ₄₅ K ₄₅	40.75	8.82	607	1.81	N ₁₂₀ P ₆₀ K ₆₀	36.33	8.78	809	1.35	1416	77.08	17.50	1.54
T ₄ -N ₉₀ P ₉₀ K ₀	45.34	13.41	673	2.49	N ₉₀ P ₀ K ₉₀	34.76	7.21	540	1.66	1213	80.10	20.53	2.11
T ₅ -N ₉₀ P ₀ K ₉₀	40.99	9.06	540	2.09	N ₉₀ P ₉₀ K ₀	34.78	7.23	673	1.34	1213	75.76	16.19	1.66
T ₆ -N ₆₀ P ₃₀ K ₃₀	42.39	10.46	404	3.23	N ₉₀ P ₉₀ K ₀	36.22	8.67	673	1.61	1077	78.61	19.03	2.20
T ₇ -N ₆₀ P ₆₀ K ₀	45.03	13.10	449	3.64	N ₉₀ P ₄₅ K ₄₅	36.66	9.11	607	1.87	1056	81.69	22.11	2.61
T ₈ -N ₆₀ P ₀ K ₃₀	38.20	6.27	319	2.45	N ₆₀ P ₆₀ K ₀	37.75	10.20	449	2.83	768	75.95	16.37	2.66
T ₉ -N ₆₀ P ₃₀ K ₃₀	43.65	11.72	404	3.62*	N ₆₀ P ₃₀ K ₃₀	37.45	9.90	404	3.06*	808	81.11	21.53	3.33*
T ₁₀ -N ₆₀ P ₀ K ₀	39.38	7.45	278	3.34	N ₆₀ P ₃₀ K ₃₀	36.76	9.21	404	2.84	682	76.14	16.56	3.03

CD = 9.19

Cost worked @ N = Rs.4.63/kg, P₂O₅ = Rs.2.85/kg, K₂O = Rs.1.37/kg, Grains = Rs.1.25/kg.

Table G.8

Results of G-type experiments conducted during 1978-79 in Kottayam District
(increase in yield of grain in q/ha and nutrient dose in kg/ha)

Variety: Jyothi.

Treatments Kharif	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Rs. investment on fertili- zers (Rs)	Treatments Rabi	Yield	Increase over control	Cost of fer- tilizers(Rs)	Returns per Rs. invest- ment on fer- tilizers(Rs)	Total cost for the year	Total yield for the year	Increase over control	Returns per Rs. invest- ment on fer- tilizers(Rs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T ₁ -N ₀ P ₀ K ₀	30.37	-	-	-	N ₀ P ₀ K ₀	30.37	-	-	-	-	60.74	-	-
T ₂ -N ₁₂₀ P ₆₀ K ₆₀	46.89	16.52	809	2.55	N ₁₂₀ P ₆₀ K ₆₀	43.03	12.66	809	1.95	1618	89.93	29.19	2.25
T ₃ -N ₉₀ P ₄₅ K ₄₅	43.66	13.29	607	2.73	N ₁₂₀ P ₆₀ K ₆₀	43.04	12.67	809	1.95	1416	86.71	25.97	2.29
T ₄ -N ₉₀ P ₉₀ K ₀	43.88	13.51	673	2.50	N ₉₀ P ₀ K ₉₀	39.44	9.07	540	2.62	1213	83.32	22.58	2.33
T ₅ -N ₉₀ P ₀ K ₉₀	43.50	13.13	540	3.03	N ₉₀ P ₉₀ K ₀	39.08	8.71	673	1.61	1213	82.58	21.84	2.25
T ₆ -N ₆₀ P ₃₀ K ₃₀	43.88	13.51	404	4.18	N ₉₀ P ₉₀ K ₀	40.17	9.80	673	1.82	1077	84.05	32.31	2.71
T ₇ -N ₆₀ P ₆₀ K ₀	43.67	13.30	449	3.70	N ₉₀ P ₄₅ K ₄₅	40.95	10.58	607	2.17	1056	84.62	23.88	2.83
T ₈ -N ₆₀ P ₀ K ₃₀	40.89	10.52	319	4.12	N ₆₀ P ₆₀ K ₀	41.48	11.11	449	3.09	768	82.37	21.63	3.52
T ₉ -N ₆₀ P ₃₀ K ₃₀	45.14	14.77	404	4.56	N ₆₀ P ₃₀ K ₃₀	42.22	11.85	404	3.66*	808	87.36	26.62*	4.11*
T ₁₀ -N ₆₀ P ₆₀ K ₀	41.29	10.92	278	4.91*	N ₆₀ P ₃₀ K ₃₀	41.48	11.11	404	3.44	632	82.77	22.03	4.03

CD = 3.67

Cost worked @ N = Rs.4.63/kg, P₂O₅ = Rs.2.85/kg, K₂O = Rs.1.37/kg, Grains = Rs.1.25/kg.

PART - III

SALIENT RESULTS

SALIENT RESULTS

The salient results obtained from the experiments conducted at the Agronomic Research Station, Karamana and the cultivators' fields in Calicut and Kottayam districts are presented hereunder.

a) AGRONOMIC RESEARCH STATION, KARAMANA

- i) Application of phosphorus and potash has no beneficial effect in increasing grain yield of rice in Karamana soils. (Experiment No.2 and 3).
- ii) Application of higher doses of P shows a tendency to reduce grain yield though it is not statistically significant. This result is consistent with the results of previous years (Experiment No.2).
- iii) Jaya variety of Paddy responds well to nitrogen application @ 120 kg/ha, the increase being to the tune of 13.32 kg grain per kg of applied nitrogen (Experiment No.3).
- iv) Normal date of sowing in the last week of June is found to be the best for getting higher yield in respect of Triveni, Culture 1907 and IR-36 varieties of paddy (Experiment No.4).
- v) For late sowing IR-36 is found to be a tolerant variety.
- vi) The optimum requirement of nitrogen in respect of the pre-release varieties are found to be as follows:
 1. Thriveni (~~check~~) 53.8 kg N/ha
 2. Culture 1907- 70.9 kg N/ha
 3. IR-36 -108.9 kg N/ha
- vii) Application of Farm Yard Manure has no effect on grain yield of rice in Karamana soils (Experiment No.8).
- viii) Though urea Briquettes (2.9 gm size) and sulphur coated urea are found to be equally good as urea split application, considering the relative efficiency, cost of application and availability of materials, urea application is still better (Experiment No.9a).
- ix) For the Kozhikode & Kottayam districts nitrogen requirement is 80 kg/ha in both the seasons for Jaya variety.

- x) In Kozhikode district P application is needed only in the rabi season and that too at a lower level of 40 kg P_2O_5 /ha.
- xi) In Kottayam district P at the rate of 20 kg/ha is found to be sufficient in both the seasons.
- xii) Line application has no beneficial effect in respect of Kozhikode district whereas for Kottayam district, application of 500 kg line per hectare is found to show some beneficial effect.
- xiii) IR-36 variety is superior to Thriveni in both the seasons in Kozhikode district.
- xiv) In respect of Kottayam district, IR-36 for Kharif and Culture 1907 for Rabi are found to be better.
- xv) In both Kozhikode and Kottayam districts IR-36 and Culture 1907 varieties responded significantly upto 120 kg N/ha.
- xvi) Application of N.P.K. at 60:60:0 during Kharif season and 90:45:45 during Rabi season in Kozhikode district and 60:30:30 for both the seasons in Kottayam district are the best combinations for getting maximum economic grain yield.
- xvii) Maximum nutrient utilization efficiency is found during Kharif season than in Rabi season in both the districts as evidenced from the grain yield data.

.....

Rainfall data and No. of rainy days of Kozhikode and
Kottayam Districts (1978-79)

Month	Kozhikode District		Kottayam District	
	Rainfall (m.m)	No. of rainy days	Rainfall (m.m)	No. of rainy days
April 1978	1.1	1	77.0	7
May 1978	555.3	19	588.0	17
June 1978	912.0	29	301.5	23
July 1978	824.8	25	505.0	23
August 1978	560.0	27	329.2	28
September 1978	34.3	7	69.6	12
October 1978	63.3	6	130.2	15
November 1978	472.8	8	200.4	9
December 1978	47.5	3	4.0	1
January 1979	-	-	-	-
February 1979	-	-	2.0	3
March 1979	1.9	1	5.4	2
Total	3473.0	126	2182.3	140