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Annual Report

1973 – '74

Kerala Agricultural University

RICE RESEARCH STATION, PATTAMBI

Post: MELEPATTAMBI - 679306

Kerala

PERSONNEL

Principal Investigator and Controlling Officer

Dr. R.Gopalakrishnan, B.Sc. (Ag.), Assoc. IARI. Ph.D.
Rice Specialist.

Agronomy

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Agronomist, All India Coordinated Rice Improvement Project.

Sri. P.N.Pisharody, M.Sc. (Ag.)
Research Officer.

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Sri. R.Ravindran Nair, M.Sc. (Ag.)
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Sri. K.Karunakaran, B.Sc. (Ag.)
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Plant Pathology

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Sri. K.M.George, M.Sc.
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Sri. S.N.Shanmughom, M.Sc. (Ag.)
Junior Research Officer.

Varietal Improvement

Sri. K.I.James, M.Sc.
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Dr. K.Karunakaran, M.Sc.(Ag.), Ph.D.
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Sri. K.Kumaran, M.Sc. (Ag.), Junior Research Officer.

Sri. G.Mathai, B.Sc. (Ag.), Junior Research Officer.

Smt. G.Santhakumari, B.Sc (Ag.) Junior Research Officer.

All India Coordinated Agronomic Experiment Scheme

Sri. N.Rajappan Nair, M.Sc. (Ag.)
Officer-in-charge.

Sri N.N.Ramankutty, M.Sc. (Ag.) Assistant Chemist.

Sri. C.A.Joseph, M.Sc. (Ag.), Statistical Officer.

Sri. [illegible] Nair, M.Sc. (Ag.), Statistical Officer.

Smt. P.Chandrika, B.Sc. (Ag.) Chemical Assistant

Experimental Farm

Sri. T.S.Venkatesan, M.Sc. (Ag.) Research Officer

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Sri. V.P.Sukumara Dev, M.Sc. (Ag.) Junior Research Officer

Pulses Improvement

Sri. Abdul Hameed, B.Sc. (Ag.), Junior Research Officer.

Seed Testing

Sri. T.C.Radhakrishnan, B.Sc. (Ag.) Junior Research Officer.

CONTENTS

INTRODUCTION

This is the 44th annual report of the Rice Research Station, Pattambi since it was established in 1927 and the 2nd, since it was taken over by the Kerala Agricultural University. During the past 44 years of its existence, it has done yoeman service to the betterment of rice culture in the State. This report covers the activities of the station from April 1973 to March 1974.

Major Achievements

The plant breeders continued their efforts to breed varieties combining high yield potential, pest resistance and excellent grain quality. They isolated the line culture 1285 which is resistant to blast and tolerant to brown planthopper from the progeny of the cross Ptb. 10 x IR.8. Another sister selection, culture 1140 also was observed to be tolerant to blast and brown planthopper. The culture 6473, isolated from the cross combination of IR.8/2 x Annapoorna, identified itself with high yield potential and excellent grain quality. These 3 strains were christened, respectively, as Jyothi, Bharathi and Sabari and released to the cultivators during the year.

Agronomy and Chemistry divisions guided their research activities to identify constraints to higher yields. Improved package of practices for the different agroclimatic regions were formulated based on these research data. Lignite fly ash, byproduct from the Neyveli Lignite Corporation, was found to be as effective as any other common liming material like calcium hydroxide or dolomite. This industrial waste is also cheaper than lime. Chemical control of weeds in direct seeded fl[illegible] rice was another item of research in the Agronomy Division. Butachlor (Machete), Monstar (RP. 17623), Propanil, C.288 and Saturn (Benthiocarb) proved to be highly effective for weed control in direct seeded rice fields. Studies on water management brought out the magnitude of loss of major plant nutrients through deep percolation. It was estimated that during the viripu season (first crop) 31.5 kg of N, 18.74 kg of P_2O_5 and 19.72 kg of K_2O per hectare are lost in percolation. The corresponding loss of these nutrients in the mundakan season are, respectively, 37.7, 28.25 and 58.52 kg per hectare.

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Investigations on pest control received due attention of the Pathologists and the Entomologists. They screened thousands of varieties for multiple resistance in close collaboration with the cooperating centres like the AICRIP Hyderabad, and the CRRI, Cuttack. Several chemicals were also screened for the control of major pests and diseases. The granular formulation of carbofuran (Furadan 3 g) proved to be highly effective against brown planthopper when it was applied at 10, 30 and 50, days after planting. Seedling dip in 0.02% solution of carbofuran protected the crop from initial pest damage. A plant protection schedule for combating the brown planthopper pest which has assumed an epidemic form in recent times was drawn up based on the results of trials conducted in the Entomology Division and this was put to test with considerable success in the vast 'Kole' lands of the Trichur district which are endemic to brown planthopper incidence.

Rice production

The virippu season was quite favourable for rice production and therefore production reached a new peak during this season. Rains failed during the mundakan season with the result there was complete crop failure. Production during this season was only 46.48 tonnes, as against 101.42 tonnes in the virippu season. The total rice production during the year was 147.9 tonnes.

Staff changes

During the second half of the year, the strength of the research staff was reduced almost to half consequent to the deputation of several of the research officers for higher studies. Sarvashri K. Karunakaran, Research Officer, U.Mathai, Abdul Hameed, T.C.Radhakrishnan and Smt. G.Santhakumari, all Junior Research Officers, joined the Agricultural college for undergoing post graduate training. Sri. T.S. Venkitesan, Research Officer and Sri. C.A.Joseph, Statistical Officer, AICRIP, joined the Agricultural University, Bangalore and Agricultural College and Research Institute, Vellayani respectively, for Ph.D. Courses. Sri. G.R.Pillai, Sri. B.Thomas and Sri. R.R.Nair to cover the posts vacated by Sri. K.Karunakaran, Sri. T.S.Venkitesan and Sri. C.A.Joseph, on promotion. The vacancies which arose consequent on these staff changes or deputation for higher studies were not filled up as an economy measure.

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Our visitors

We were previleged by the visit of the following eminent persons during the year

Sri.C.H.Randir Singh	Member, Planning Commission on Agriculture, Government of India.
Sri.Vella Eacharan	Honourable Minister for Harijan Welfare and Community Development Government of Kerala.
Sri.Bernad Rechmann	Agronomist, Indo German Nilgiris Development, Tamilnadu.
Sri.C.Thomas, I.A.S.	Chairman and Managing Director, Kerala Land Development Corporation Ltd., Government of Kerala.
Sri.T.K.Divakaran	Honourable Minister for Public Works, Government of Kerala.
Sri.Vakkom Purushothaman	Honourable Minister for Agriculture, Government of Kerala
Sri.E.John Jacob,	Member, Kerala Legislative Assembly
Sri. M.S.Pawar,	Vice Chancellor, Mahatma Phule Krishi Vidya Peeth and Konkan Krishi Vidya Peeth, Karjat, Maharashtra.
Smt. Kusum Nair	Journalist, Bombay.
Dr. S.K.Mukkerjee,	Dy. Director General, I.C.A.R., New Delhi.
Dr. Ivan W.Buddenhagen	Pathologist, All India Coordinated Rice Improvment Project, Hyderaba
Sri.A.J.Chacko	Agricultural Expert, Nigeria
Sri.S.Ananthakrishnan, I.A.S.,	Additional Production Commissioner, Government of Kerala.
Dr. C.M.Jacob	Vice Chancellor, Kerala Agril. University
Dr. M.R.G.K.Nair	Director of Research, Kerala Agril. University, Mannuthy.

Training

Sri. .N.Pisharody, Research Officer (Agronomy) attended the summer institute on soil science at the College of Agriculture, Anand from 1-5-73 to 1-6-73. Sri. R.R.Nair, Junior Research Officer participated in the summer institute on water management in rice production held at CRRI, Cuttack from 1-5-73 to 15-6-74.

Finance

This station received a sum of Rs. 10,11,900/- under various research schemes during the year. Out of this, the share of the ICAR was Rs. 1,95,200/- and that of the State Government Rs. 8,16,700/- The expenditure incurred amounted to Rs. 8,54,081.11 on all schemes. The receipt on account of sale of farm produce was Rs. 2,70,137.18. This does not include the cost of paddy seed supplied to various seed farms in the state on credit which will come to Rs. 1,20,000/-

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CROP WEATHER

The 1973-74 'virippu' (April- September) season was favourable for the rice crop with well spread rainfall, moderately high temperature and high relative humidity. Rainfall during this season was 1972 mm spread over 78 rainy days as against 2073 mm of rains in 79 days during the previous virippu season. The maximum amount of rainfall (723.6 mm) was received in June, the deviation from the normal being 119 mm. Bright weather prevailed at the time of harvest. The climatic conditions were thus quite favourable for crop growth both in uplands and in the wetlands. Production of rice, therefore, reached a new peak during this season. The 'mundakan' season (October-March), however, was marked by unusual drought conditions during the reproductive and ripening stages of the crop coupled with severe outbreak of brown planthopper. Bright sunny days, high temperature and hot winds desiccated the tanks and wells in the farm in December and this thwarted all efforts of saving the crop from complete failure with lift irrigation. There was considerable decline in rice production in general and even total crop failure occurred in some of the fields.

The incidence of brown planthopper although inflicted heavy loss in yield, it was, however, made use of in screening varieties tolerant to this malady. Of all the varieties grown in the farm during this season only the cultures 1285 and 1140 of the cross Ptb. 10 x IR.8 and Thriveni were observed to be tolerant to brown planthopper. Among the exotic varieties Leia from Bangladesh was found to be resistant. The variety IR.26 from IRRI, Philippines claimed to be resistant to brown planthopper was observed to be susceptible under our conditions. Tungro and grassy stunt virus diseases were also observed.

Table- XI. Meteorological data for the year 1973-74

	Month	Rainfall (mm)	No. of rainy days	Mean maxi. temp. °C	Mean mini. temp °C	Relative humidity (%)	Hours of bright sun shine
1973	April	147.5	5	35.3	25.0	93	231.0
	May	124.2	5	34.0	23.9	93	233.5
	June	723.6	22	29.9	23.5	95	117.2
	July	506.1	21	29.4	22.9	92	113.3
	August	334.2	22	27.5	22.3	97	93.3
	September	36.6	3	21.1	23.1	95	230.1
	October	254.7	15	21.4	22.2	96	177.6
	November	135.2	4	32.1	21.0	92	233.8
	December	5.2	1	31.0	20.5	85	237.[illegible]
1974	January	0.0	--	33.0	17.9	82	316.1
	February	0.0	--	35.4	19.3	84	[illegible]
	March	11.2	1	37.3	[illegible]	93	[illegible]

VARIETAL IMPROVEMENT

The rice breeders made a remarkable achievement in isolating a variety ' Jyothi ' resistant to blast disease. They could release two more varieties having high yield potential during the year, ' Bharathi ' and ' Sabari ' Jyothi and Bharathi are also tolerant to brown planthopper

The breeding programme in the Varietal Improvement Division had the following objectives

i) To breed photoperiod insensitive red and white kernelled, medium duration, semidwarf cultures having very similar grain shape and size together with quality attributes of the popular photoperiod sensitive variety Co. 25,

ii) To improve panicle and grain characteristics of early and medium duration varieties;

iii) To transfer the semidwarf gene to tall varieties,

iv) To breed varieties resistant to major diseases like blast and sheath blight and to major insect pests like gallmidge, planthopper and leafhopper, and

v) To evolve red riced high protein lines

Comparative Yield Trials of Advanced cultures

A. Medium duration cultures

The following medium duration cultures were evaluated during the year in 2 replicated yield trials one each in the first and second crop season. The levels of nutrients given were 80 kg N, and 40 kg each of P_2O_5 and K_2O per hectare.

Cultures		Parentage	Rice colour
Culture	7779	IR.8 (IR.533 x Ptb.15 x T(N) 1)	White
,,	7781	-do-	White
,,	7782	-do-	White
,,	15561-6	IR.5 x C.P.12	White
,,	15573-3	-do-	White
,,	15612-1	-do-	White
,,	1140	Ptb.10 x IR.8	Red
,,	6473	IR.8/2 x Annapoorna	Red

The data on flowering duration and grain yield of these two trials are furnished in Table-B.1

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Table B.1. Summary of results of yield trials of medium duration cultures

Cultures/ varieties		Flowering duration (days)		Mean grain yield (kg/ha)	
		I crop	II crop	I crop	II crop
Culture	7779	98	82	5031	3008
,,	7781	98	82	5439	2678
,,	7782	99	82	5161	3308
,,	15561-6	106	85	4099	2240
,,	15573-3	94	89	5064	3382
,,	1140	90	69	6144	3162
,,	6473	94	84	6125	2767
Jaya		93	73	6468	2931
IR.8		97	87	5316	2342
Aswathy		95	81	5769	2855
IET.2295		--	74	--	1866
IR.5		102	--	4151	--
C.D (0.05)		--	--	973	530

During the virippu season, Jaya, 1140, 6473, and Aswathi were on par in grain yield. In the mundakan season, the culture 15573-3 ranked first among the varieties/cultures tried, although it was statistically on par with 1140, 7779, 7782, IR.8, Jaya and Aswathi.

B. Short duration cultures

There were two replicated yield trials of advanced short duration cultures during the year, one each in the first and second crop seasons. The check varieties were Annapoorna, Rohini and Thriveni. The varieties were transplanted at a spacing of 20 cm x 15 cm. The fertilizer schedule adopted was 60 kg N, 30 kg P_2O_5 and 30 kg K_2O per hectare.

The cultures under trial were the following -

Cultures	Parentage	Rice colour
7753	Annapoorna-28 x Leb Mue Nahng	White
21278	-do-	White
21592	-do-	White
21491	IR.8/2 x Ptb. 7	Red
1285	Ptb.10 x IR.8	Red
12035	IR.8/2 x Annapoorna-28	White

The data on flowering duration and grain yield of these 2 trials are furnished in Table B2.

Table B.2. Summary of results of yield trials of short duration cultures

Cultures/ Variety	Flowering duration (days)		Grain yield (kg/ha)	
	I Crop	II Crop	I Crop	II Crop
Cul. 7753	88	76	3938	2469
,, 21278	83	77	4103	2822
,, 21592	89	77	4242	2683
,, 21491	86	75	4204	2601
,, 1285	66	73	4153	3007
,, 12035	80	70	4469	2701
Annapoorna-28	77	65	3951	2042
Rohini	80	55	3976	1926
Thriveni	78	70	4305	2803
C.D. (0.05)	--	--	N.S.	481

The data on grain yield recorded during the first crop season revealed no significant differences between the test varieties. In the second crop season, culture 1285 ranked first in grain yield although it was on a par with Culture 21278, Thriveni, 12035, 21592 and 21491

Preliminary field Trials

A. Medium duration cultures

Twenty three (23) cultures from 6 cross combinations were evaluated in a preliminary yield trial during the 1st crop season (virippu)

The trial had 2 replications and a plot size of 1.8 x 2.0 M (net). The spacing adopted was 20 cm x 15 cm and the total NPK dose was 80:40:40 kg/ha, respectively.

The details of the selected cultures are furnished in Table B.3 along with grain yield.

Table B.3. Parentage, flowering duration, and grain yield of medium duration cultures under preliminary yield trial

S. No	Culture No.	Parentage	Flowering duration (days)	Grain yield (kg/ha)	Rice colour
1	7936	Ptb. 15 x T(N) 1	94	5139	Red
2	7943	IR.8 (IR.533 x Ptb.15 x T(N)1	95	5069	White
3	1-5-5	T(N) 1 x Co. 25	108	4792	White
4	925	-do-	101	4792	White
5	1018	-do-	106	4792	White
6	7919	Cul.28 x Leb Mue Nahng	91	4653	White
7	1016	T(N) 1 x Co.25	107	4653	White
8	1017	T(N) 1 x Co.25	109	4653	White
9	1-5-4	-do-	109	4444	White
10	1066	-do-	105	4444	White
11	1014	-do-	106	4375	White
12	1063	-do-	107	4375	White
13	1065	-do-	105	4305	White
14	1012	-do-	109	4236	White
15	7930	IR.8/2 x Ptb 7	97	4167	Red
16	7918	Cul.28 x Leb Mue Nahng	91	4097	White
17	7942	IR.8 (IR.533 x Ptb.15 x T(N)1	99	4028	White

B. Short duration cultures

Twenty six short duration cultures from 4 cross combinations were tested in this preliminary yield trial during the 1st crop season.

The trial had 2 replications and a plot size of 1.20 M x 2.25 M (net). The spacing adopted was 15 cm x 15 cm and the total NPK dose was 60 30 30 kg/ha

The details of the cultures selected are furnished in Table B.4 together with grain yield

Table B.4. Flowering duration and grain yield of early duration cultures under preliminary yield trial

Sl N	Culture No.	Parentage	Flowering duration (days)	Grain yield	Rice Colour
1	7944	Cul.11812 x T (N) 1	81	4490	White
2	7878	IR.661 x Cul.28	80	4444	Red
3	7886	-do-	79	4398	White
4	7894	-do-	79	4259	White
5	7888	-do-	77	4259	Red
6	7941	Pt.8(IR.533 x Ptb.15 x T(N) 1)	81	4212	White
7	7879	IR.661 x Cul.28	81	4167	Red
8	7885	-do-	83	4167	White
9	7898	-do-	79	41[illegible]	White

<u>Comparative Yield Trial of T. 442 lines and R.D.1</u>

Seven lines of T.442 and the variety RD.1 which are suited for flooded and deep water areas were put under a comparative yield trial under normal conditions and incidently to multiply their seeds. Jaya was used as the check variety (Table B.5). The fertility level was 80 40 40 NPK kg/ha. The trial was laid out during the mundakan (second crop)season.

As some plants in all the plots showed symptoms of grassy stunt virus infections, a count of such plants was made and the affected plants were removed. The mean percentage of infected plants in the different cultures/varieties and grain yield are presented in Table B.5.

Table B.5 Percentage of grassy stunt affected hills and grain yield

Variety/cultures	Mean percentage of grassy stunt affected hills	Grain yield (kg/ha)
T. 442-36	9.00	2777
T. 442-46	1.43	3231
T. 442-57	13.43	2415
T. 442-65	3.29	2906
T. 442-14B-20	1.93	3634
T. 442-173-35	3.29	3012
T. 442-353-58	5.43	3095
RD-1	28.50	1812
Jaya	21.07	1840

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The check variety Jaya and RD.1 were highly susceptable to grassy stunt virus and they recorded very poor yields compared to the rest of the cultures tried. The data were, however, not subjected to statistical analysis because of variation in plant population between plots.

Yield Potential of Satya, Soorya, Suhasini

The new Maharashtra rice varieties Satya, Soorya and Suhasini were tried in a comparative yield trial against the check varieties Jaya, Sabari and Triveni during the mundakan season. The fertilizer schedule adopted was 80 . 40 . 40 (NPK) kg/ha. The data on grain yield revealed that the Maharashtra rices recorded slightly lower yield than the popular varieties Jaya and Sabari. However, the differences between these varieties were not **statistically** significant (Table B.6)

Table. B.6. Summary of results of the yield trial of new Maharashtra rice varieties Satya, Soorya and Suhasini.

Variety	Plant height at maturity (cm)	Productive tillers per hill	Duration from sowing (days): 50% flowering	Duration from sowing (days): Maturity for harvest	Mean yield in kg/ha (14% moisture)
Satya	75.0	8.8	97	126	3010
Soorya	71.0	10.0	97	126	3038
Suhasini	64.5	11.3	97	126	3269
Jaya	77.8	9.8	97	126	3409
Sabari	75.4	10.1	101	128	3323
Thriveni	76.4	8.9	79	107	2449
C.D. (0.05)					423

Varietal trials in uplands

A. Observational trial of ARC cultures

A total number of 516 ARCcultures were grown in rainfed up lands under a fertilizer schedule of 60 kg N, 50 kg P_2O_5 and 50kg K_2O per hectare

As there was a good incidence of leaf blast in the seedling stage of the crop, blast scoring of all the cultures was done.

Out of the 516 cultures 441 showed blast scores less than 3 and from among these a total number of 48 cultures were selected based on uniformity and yield for further multiplication and trial.

B. Observational trial with IARI and Pattambi cultures

Three IARI cultures and six Pattambi cultures were compared with six check varieties in an unreplicated trial.

Based on the general performance of the cultures, 5 entries were selected for further multiplication and comparative yield trials (Table B.7)

Table B.7. Grain yield of IARI cultures

Cultures	Total duration	Grain yield (kg/ha)	Blast score
IARI. 11295	107	3283	3
IARI. 7046	106	3100	3
IARI. 11094	97	2533	4
PTB. 21491	128	3217	2
PTB. 12814	115	3067	3

Observational trial with some CRRI cultures in wet lands

An observational trial was conducted with 8 cultures from CRRI Cuttack during the 1st crop season to assess their yield potential und r a common fertilizer schedule of 60 30 30 NPK (kg/ha).

Out of the 8 cultures, CR. 36-148 with a total durati n of 114 days gave the highest yield of 5318 kg/ha. This culture has since been released as a variety under the name Supriya in Orissa.

Observational trial of new japonica x indica cultures from CRRI, Cuttack

An observational trial was laid out to study the performance of new japonica x indica cultures received from CRRI, Cuttack. The check varieties were Jyothi, Rohini, Thriveni, Annapoorna, Bharathi, Sabari, Jaya and IR.8

All the cultures flowered within 85 days and were harvested on 15-10-73.

The yield data are furnished in Table B.8.

Table B.8. Grain yield data of new japonica x indica cultures

Cultures/variety		Grain yield (kg/ha)	Cultures/variety	Grain yield (kg/ha)
H x CR. 1014/2	-1	5392	S x S- 1	4902
,,	-2	6373	,, - 2	6005
,,	-3	6005	,, - 3	5637
,,	-4	6250	,, - 4	5270
,,	-5	6250	,, - 5	5392
S x G	-1	5392	H x Z- 1	6005
,,	-2	5270	,, --2	5515
,,	-3	5760	,, - 3	5250
,,	-4	5392	,, - 4	6373
,,	-5	5637	,, - 5	5740
,,	-6	5392	,, - 6	5760
J x S	-1	6373	H x S- 1	6127
,,	-2	6127	J x N- 1	4044
,,	-3	5147	H x K- 1	4902
,,	-4	5024	,, - 2	5392
,,	-5	6005	,, - 3	5637
,,	-6	5392	,, - 4	4779
J x K	-1	6127	,, - 5	5882
,,	-2	5882	,, - 6	4902
,,	-3	6005	Jyothi	6618
,,	-4	6127	Rohini	5637
,,	-5	5270	Thriveni	6005
,,	-6	5392	Annapoorna	5392
,,	-7	5025	Bharathi	5024
H x G	-1	5147	Sabari	6250
,,	-2	5392	Jaya	6373
,,	-3	5147	Aswathy	5515
,,	-4	5270	I.R.8	6127
,,	-5	5515	Culture 12035	5882
,,	-6	5637		

Breeding materials in the early evaluation stages

a. Pedigree Rows

A total of 1182 F lines from previous year's single plant selection were raised in pedigree rows during the 1st crop season and a total of 73 single plants were selected for further studies and evaluation.

The composition of the pedigree rows and details of parentage and the number of single plants selected for each material are furnished in Table B.9

Table B.9. Details of the materials under pedigree rows

Sl No	Cross/Pedigree	Generation	No. of lines raised	No. of single plants selected
1	Mashoori x 6473	F4	71	19
2	12035 x 10074	,,	6	2
3	10074 x 12035	,,	3	--
4	6967 x 11828	,,	17	1
5	6473 x 12035	,,	1	--
6	12035 x 6473	,,	5	1
7	12035 x Ptb.12	,,	1	--
8	12035 x Ptb 15	,,	2	--
9	Thriveni x Ptb.15	,,	1	--
10	MN.54-42 x 6473	F3	55	--
11	Aswathy x 6967/2	,,	33	--
12	Aswathy x 6967	F4	86	5
13	Rohini x 6967	,,	36	2
14	DGWG x Ptb.15	,,	45	--
15	IR.8 x Ptb.15	,,	29	1
16	IR.8 x Cul.3	F3	47	--
17	IR.8 x Cul.6-8-8	F6	5	--
18	Rohini x Ptb.15	,,	4	--
19	DGWG x Ptb.7	,,	10	--
20	Co. 25 x IR.262	F7	16	8
21	T(N)1 x Ptb.9	F9	10	--
22	Pookkalisamba x Annapoorna	F7	27	--
23	Pookkalisamba x Annapoorna	F8	8	1
24	Pookkalisamba x CR.28	,,	1	--
25	Pookkalisamba x T(N) 1	,,	3	--
26	IR.8 x Co.25	F9	31	4
27	T(N) 1 x Co.25	,,	13	3
28	(T(N) 1 x Co.25) x T(N) 1	F3	38	1
29	(T(N)1 x Co.25) x Co.25	,,	23	--
30	Rohini x Ptb.10	F4	37	1
31	Induced mutants in MN.54-42	M4	453	1
32	MN.54-42 x H4	F5	65	3

B. F2 generation of new crosses

Sixty five F2 families from 17 cross combinations were raised during the second crop season and a total of 463 single plants were selected for further studies (Table 3.10)

Table B.10. Details of the F2 generation materials

Sl No	Cross combinations	No.of F2 families	No.of single plants selected
1	Thriveni x Cul. 12814	2	157
2	C4. 63 x Thriveni	2	37
3	6473 x W. 12708	1	4
4	MN.54-42 x IR.20	20	58
5	MN.54-42 x C.4-63	8	40
6	T(N) 1 x Ptb.26	3	--
7	Jaya x(Cul.28 x Leb Mue Nahng)	4	48
8	Jaya x Pokkali	2	18
9	Jaya x 72 (Assam collection)	1	--
10	Jaya x ARC. 10764	1	--
11	Ptb.23 x Thriveni	1	--
12	Paingamu ka local x Jaya	1	--
13	Jaya x Dunghan Shali	2	30
14	Jaya x Ptb.28	5	--
15	Jaya x 587-4	1	28
16	T(N) 1 x Ptb.28	5	--
17	10074 x Annapoorna	6	19

C. F1 Generation of fresh crosses

F_1s of 4 new crosses were raised during II crop season in pots and seeds collected (Table B.11)

Table B.11. New crosses effected during the second crop season

Sl No	Cross combinations	No.of F_1 plants from which seeds collected
1	Annapoorna x CH 42	6
2	Annapoorna x NC 1620	2
3	Annapoorna x Chinsura 7	4
4	10074 x 1285	10

D. M_1 generation of irradiated Oorpandy

Seeds of Oorpandy, a saline resistant variety which is fully awned, were got irradiated with 2 doses of gamma rays (11 KR and 32 KR) on 18-6-73 at the Baba Atomic Research Centre, Trombay.

Nursery was sown in pots on 20-7-73 and seedlings were transplanted in singles with a spacing of 20 x 15 cm on 16-8-73. Flowering commenced on 28-11-73.

A total of 240 single plants (120 from each treatment) were individually harvested and seeds collected for raising M_2 generation in 1974-75.

The main purpose of this work is evolution of a saline resistant variety without awn.

Varietal Museum

An assemblage of recently released varieties and promising pre-release cultures was made and grown as a varietal museum. The number of varieties in the varietal museum during the I and II crop seasons were as follows (Table 3.12)

Season	No. of varieties in the varietal museum		
	Short duration	Medium duration	Total
I Crop	13	21	34
II Crop	16	18	34

Release of new high yielding varieties

During the year under report 4 advanced rice cultures found promising were proposed to the Variety Evaluation Committee of the Kerala Agricultural University on 21-3-1974.

Out of these, the Variety Evaluation Committee recommended 3 cultures and these cultures were proposed to the State Seed Sub Committee for release. They were cultures 1285, 6473 and 1140.

The State Seed Sub Committee approved the release of all the three cultures proposed. The details of the released cultures are furnished below.

Culture 1285 is a dwarf line extracted from the cross Ptb. 10 x IR.8 and is of 110-115 days duration. It is photo insensitive and can be grown under all the usual rice growing conditions of the State as also in the lake bed regions of Kuttanad and Kole areas. The grain is medium bold and the husk colour is straw with brown furrows. The kernel colour is red and is translucent. Milling and cooking quality of the culture is excellent and hence fetches a premium price over the other high yielding varieties. The yield range is 4-5 tonnes per hectare. It is resistant to blast and has exhibited field tolerance to brown hopper infestation under heavy pressure of brown hopper incidence during 1973-74 second crop season. This variety was christened by the State Variety Release Committee as " Jyothi " (Ptb.39).

Culture 6473 named as ' Sabari ' (Ptb.40) is a medium duration (125-130 days) selection from IR.8/2 x Annapoorna 28. It is photoinsensitive and can be grown under the normal rice growing conditions prevailing in the State. It has also become popular both in Kuttanad and Kole areas. Its grain is medium bold with tip awned. Husk colour is straw and kernel colour white. It has also white abdomen in the kernel. In many trials, it has out-yielded IR.8 and Jaya. Being red kernelled it fetches premium price over IR.8 or Jaya in this state. The yield range is 5-6 tones per hectare.

Culture 1140 or Bharathi (Ptb. 41) is also a medium duration selection from among the hybrid progenies of the cross Ptb.? x IR.8. It is photoinsensitive and can be harvested in about 120-125 days. The grain is medium bold. Husk is straw coloured. The rice is red and is without white abdomen. It is also moderately resistant to blast and has field tolerance to brown plant-hopper. It is taller than IR.8 or Jaya. In many of the trials, it has recorded higher yields than IR.8 and Jaya although it is about a week earlier than them. The yield range is 5 to 6 tones per hectare.

VARIETAL IMPROVEMENT WORK DONE UNDER THE ALL INDIA COORDINATED RICE IMPROVEMENT PROJECT

The following experiments were conducted in the All India Coordinated Rice Improvement Project (Coordinated variety trials) during 1973-74

Uniform Variety Trials- IA, IB and II

The object of these trials was to study the comparative performance of very early maturing (80-90 days duration) IA, early maturing (90-110 days duration) IB and medium duration (120-135 days duration) cultures-II. In the very early duration trial (UVT-IA) three cultures from the cross IR8 x W22 namely, 79-14, 79-22 and 79-24 outyielded Bala, the highest yielding short duration check variety. Other check variety was Cauvery which took 12 days more than Bala to mature. All the twelve cultures under comparision outyielded Cauvery.

Out of the 17 cultures tried in the early maturing group (UVT-IB) MTU. 5169, MR.13 and RP. 260-228-1 registered higher yield than Ratna, the check variety.

In the Uniform Variety Trial-II where medium duration cultures were tested, three cultures RP.84-39-1, J. 3756 and RP.4/14 registered significant increases in yield over Jaya. It is interesting to note that all these three cultures also recorded higher mean yields than Jaya in all test locations in India. Further, tolerance of RP.4/14 against Brown Planthopper reported from this station for the first time was also confirmed in tests conducted at AICRIP centre, Hyderabad.

Preliminary Variety Trial-I and II

Out of the 36 cultures tested in the early maturing group (PVT-I) 23 cultures outyielded Cauvery the control plot in this trial. Among them the highest yielding cultures were NPL. 48-116 followed closely by or 45-53, MTU. 511 and MTU 6368.

In PVT.II where medium duration cultures were tried 30 cultures outyielded Jaya and check variety. Cultures 6473 and 6475 nominated from this station ranked first in all test locations in India.

National Breeding Nursery

379 cultures were tested to study their reaction to pests and diseases but none of them possessed any multiple resistance.

Brown hopper resistant varieties

Eighteen cultures resistant to brown planthoppers were tested. Out of them one culture IR-1539-823-1-4 (IR.24 x Mudgo x IR.8) showed field resistance to brown planthopper. This culture is being multiplied for further tests.

International Rice Yield Nursery

36 cultures were tried in the above trial. IR.26 was also included in this trial which was released as a brown hopper resistant variety. When the trial approached maturity, severe incidence of brown plant hoppers was noted. Taking advantage of the brown hopper build up, all the 36 lines were screened for their resistance to the pest. It was found that IR.26 was susceptible to brown hopper burn at Pattambi which was later confirmed under other Indian conditions. Mala, a Bangaladesh entry escaped from brown hopper attack. This variety is being multiplied for further trials.

AGRONOMY

Agronomy Division devoted its attention to solve problems relating to upland and lowland rice culture. The results revealed that

* efficiency of applied nitrogen in uplands is increased by compacting the soil to a bulk density of 1.318.
* crop weed competition is critical during the early vegetative phase.
* Machete (Butachlor) and Propanil are excellent herbicides for weed control in direct seeded flooded rice.
* physiologic maturity of the rice seedlings and not the chronological age, determines the productivity of rice plants

Studies on water management brought about the magnitude of the loss of plant nutrients in deep percolation in flooded rice fields

Bulk density of soil on nitrogen response and yield

Efficiency of applied nitrogen is much reduced in rainfed uplands due to rapid nitrification of applied fertilizers and its subsequent loss through percolating waters. Compaction of soil to a desired bulk density is therefore considered to minimize such losses. The present study was undertaken in 1971-72 to study the effect of soil compaction on nitrogen response and yield of the **upland rice** variety, Ptb. 28.

The treatments comprised of 3 levels of compaction (bulk density: 1.200, 1.318 g/cc) and three levels of nitrogen (0,40,80 kg per hectare). The design of the experiment was split plot, with compaction as major treatment and nitrogen as minor treatments. Seeds of the test variety were dibbled at 15 cm x 15 cm spacing adopting a seed rate of 80 kg/ha. Compaction was done using stone rollers weighing 80 and 330 kg.

Soil compaction with the 330 kg roller effected significant yield increases over no compaction and compaction with the light roller (Table 4.1) At all the levels of nitrogen, an increase in the bulk density of the soil, increased the grain yield to a considerable extent. Response to nitrogen was linear and significant with the 80 kg N/ha level recording the highest yield. The rate of response to applied nitrogen was 4.3 kg per kg of N for the 40 kg level and 11.1 kg of grain per kg N for the 80 kg level.

The higher bulk density of the soil favoured better response for applied nitrogen, although the interactional effect was not statistically significant. These results agree with the findings reported earlier in 1971-72. This investigation has conclusively proved that rice yields in the rainfed uplands could be considerably increased by applying 80 kg N/ha and by compacting the soil after sowing, to a bulk density of 1.318 g/cc.

Table 4.1. Grain yield (kg/ha) as influenced by bulk density of the soil and applied nitrogen

Compaction	Bulk density (g/cc)	Nitrogen applied (kg/ha) 0	40	80	Mean	C.D. (0.05)
No compaction	1.200	546	630	1204	793	
Compaction with 80 kg roller	1.207	504	742	1386	877	90
Compaction with 330 kg roller	1.318	560	756	1695	1137	
CD (0.05)			141			

Rotation Experiment

With a view to explore the feasibility of raising more than one crop in the conventional single crop wet lands (Pallyals), a one year two crop rotation experiment was initiated during the first crop season of 1972-73. The experiment was laid out in randomised block design with three replications. There were 8 treatments comprising of a short duration rice-Rohini, in the first crop season in all the plots followed by 8 different kinds of crops in the second crop season (Table .2). The cultural and manurial practices have been followed to suit each crop under local conditions. In addition to the economics, the influence of different rotations on soil fertility is also being studied.

In the first season of the trial, that is, the first crop season of 1972-73, the grain yield of rice in all the treatments did not show any significant variation. That evidently reflected the homogeniety of the experimental plot. In the second crop season, groundnut, cowpea, tapioca, gingelly, cholam, ragi, sunflower and rice were tried. Rice, tapioca, gingelly and [illegible] gave encouraging results. The net income from these crops were more or less equal.

Since sunflower and cholam were not found to come up well in the second crop season, these two crops were removed from the rotation and substituted with green gram and cotton respectively.

Table .2. Summary of yields (kg/ha) obtained for different crops in rotation during 1972-73 and 1973-74

Trial No.	Crop sequence	Yield (kg/ha) First crop 72-73	73-74	Second crop 72-73	73-74
1	Paddy-Paddy	2683	2381	3842	1648
2	Paddy-groundnut(TMV.2)	2715	2667	1048	361
3	Paddy-cowpea(Pusa dofasli)	2819	2267	4137	2373
4	Paddy-Cholam(CSH-1) Cotton in 73-74 (Rabi)	2788	2191	1375	drought affected
5	Paddy-gingelly (local)	2886	2348	249	112
6	Paddy-tapioca(Mal vella)	2864	2257	8613	4429
7	Paddy-ragi (Dibiyasinha)	2873	2295	1056	1638
8	Paddy-sunflower, greengram in 73-74 (Pusa baisakhi)	2810	2378	295	30[illegible]

Plot yields did not differ significantly during the virippu season. However, the highest yields were obtained from the plots where groundnut was grown in the previous season. Rice grown after cholam recorded the lowest yield. Obviously, the leguminous crop was helpful to conserve soil fertility; the millet crop, on the other hand, seemed to deplete it.

During the second crop season, yields of all the crops except ragi were lower than that of the previous second crop season because of severe soil moisture stress consequent on the failure of pre-North-East monsoon. Ragi survived the drought and produced satisfactory yields.

Fertility status after the harvest of the second crop (Table A.3) showed that available N was maximum in the paddy-greengram rotation. The highest rate of N removal occurred in rice-ragi rotation. Rice-groundnut and rice-tapioca rotations tended to reduce the pH of the soil

Table A.3. Fertility status of the sub plots after the harvest of the second crop of 1973-1974

Trial No.	N	P	K	pH
1	1.26	32.8	228.5	5.5
2	1.06	22.6	165.7	5.2
3	0.98	25.6	197.1	5.3
4	1.43	26.2	183.6	5.4
5	1.36	29.2	174.8	5.4
6	1.41	26.[illegible]	17[illegible].2	5.[illegible]
7	1.13	24.6	161.2	5.3
8	1.44	27.2	165.7	5.4

Competing ability of rice with weeds in rainfed uplands

Paddy seeds are either sown broadcast or dibbled in the rainfed uplands with the onset of south west monsoon. Severe crop-weed competition always limits production in these uplands. In order to study the competing ability of rice with weeds, an experiment was initiated in the 'Virippu' season of 197[illegible]-7[illegible] and was continued during the corresponding season of 1973-74 also.

The design of the experiment was randomized block design with 3 replications and 12 treatments (Table A.4). The test variety was Thriveni dibbled at a spacing of 15 cm x 15 cm. A seed rate of 80 kg/ha was adopted. The experimental plots received basal application of 30 kg N, 40 kg P_2O_5 and 40 kg K_2O per hectare. At tillering and panicle initiation stages, nitrogen was top dressed at 25 kg/hectare each time. In order to ensure uniform stand of weeds in all the plots, weed seeds comprising of Cleome viscosa and Echinochloa crusgally were also sown broadcast at the rate of 5 kg per ha. along with fertilizers Germination of paddy as well as weed seeds was excellent in all the plots.

The climatic conditions were quite favourable for crop growth during the season and therefore, yields were far higher than those recorded in the previous season of the experiment.

As in the previous season, the time of weed removal was observed to influence production significantly. Weed free condition maintained by frequent hand weeding were observed to be invariably more favourable for rice. It helped to produce more number of productive panicles per hill, heavier panicles and higher grain yield. Removal of weeds once on the 30th day after sowing as in treatment No. 9 recorded, however, as much yield as in Tr.3 which was kept free of weeds up to the 30th day of sowing by 3 handweedings. The difference in yield between Tr.3 and 9 was 237 kg/ha and this difference was not statisticallysignificant. The reduction in yield when weeds are removed only after 45, 60 and 75 (Tr. 10,11,12) days after sowing was due to the fact that the crop suffered from very heavy weed competition in the early stages of growth and it could not afterwards recover its vigour and usual growth rate. These treatments produced fewer number of productive ears per hill with lighter panicles.

The results of this experiment conclusively prove that the crop weed competition should be checked thoroughly during the period of active growth of rice seedlings. This condition could be achieved either by keeping the crop weed free up to 30 days after sowing or by giving the crop a hand weeding on or about 30th day after sowing. The latter practice is more practical since the gain or loss in yield on account of either of the two practices is only marginal.

Table 4.4. Effect of weed free condition and time of weed removal on rice yield and associated characters .

Treatments		Grain yield (kg/ha)	Panicles/hill	Panicle wt. (g)	Dry wt. of weeds at harvest (kg/ha)	Increase/decrease in yield kg/ha over Tr.3	Tr.9
1. Control (no weeding)		2206	5.80	1.52	5414	-1632	-1395
2. Weed control up to	15 DAS	3467	7.33	1.99	2624	- 371	- 134
3. -do-	30 ,,	3838	7.93	2.07	1103	(3838)	+ 237
4. -do-	45 ,,	3964	8.43	2.21	449	+ 126	+ 363
5. -do-	60 ,,	3885	7.99	2.24	473	+ 47	+ 284
6. -do-	75 ,,	3861	8.87	2.27	355	+ 23	+ 260
7. -do-	90 ,,	4176	8.23	2.23	331	+ 338	+ 575
8. Weed removal on the	15 ,,	3097	7.19	2.22	3254	- 471	- 504
9. -do-	30 ,,	3601	8.07	2.24	1237	- 237	(3601)
10. -do-	45 ,,	3310	8.13	1.93	788	- 528	- 291
11. -do-	60 ,,	3152	6.37	1.79	473	- 686	- 449
12. -do-	75 ,,	2758	6.20	1.67	370	-1080	- 843
C.D. (0.05)		457	1.66	0.44	717		

D.A.S. days after sowing

Influence of age of seedlings and spacing on grain yield

Age of seedlings has a substantial influence on rice yield. This is especially true of some of the dwarf and photo-insensitive varieties. An experiment was initiated in the first crop season of 1973-74 to study the influence of age of seedlings on yield and associated characters. The effect of spacing on the age of seedlings was also studied in this experiment.

The treatments comprised of 12 combinations of 4 age groups (21,28,35,42 days after sowing) and 3 spacings (15 x 10 cm, 15 x 15 cm and 15 x 20 cm) (Table 4.4). The transplanting in all the treatments done on the same date so that field environment would be the same and only the seed bed conditions would vary. The design of the experiment was randomised block cc replicated 4 times. At planting, nitrogen, phosphorus (P_2O_5) and potash (K_2O) were applied at 45 kg each per hectare. At panicle initiation, nitrogen was topdressed at 45 kg per hectare. The test variety was Jaya. Age of seedlings and spacing contributed no significant effect on grain yield during the first crop season. The maximum yield, however, was produced by the seedlings planted 35 days after sowing. The seedlings aged 42 days recorded the lowest yield, the percentage of decline in yield being 12.2 compared to 35 days old seedlings. The yield component that was least affected by the chronological age was the tiller number. Seedlings of all the age groups produced almost the same number of ear bearing tillers/hill. This might be the reason why there was no marked variation in yield between age groups. Spacing, on the contrary affected variation in productive tillering, though not significantly (Table A.6). Wider spaced hills produced larger number of tillers per hill irrespective of the age groups. The results tend to indicate that during the cloudy viruppu season the chronological age (within the maximum age limit studied i.e. 42 days) was not a deciding factor for rice production.

Age of seedlings however exerted significant yield variation during the sunny and hot mundakan season. The flowering duration of the crop was also reduced in this season. The younger seedlings, i.e. 21 days and 28 days old, produced significantly higher yields over the older seedlings i.e. 35 and 42 days. The yield component that affected the productivity of older seedlings was the panicle weight although the older seedlings produced as much tillers as the younger ones.

The effect due to the spacings under study was not significant although during the second crop season closer spacing yielded the highest. It is observed that the wider spaced plants produced larger number of tillers per hill as in the previous season.

The study indicated that chronological age of seedlings should be given due consideration in the second crop season since the plants attain physiological maturity earlier in this season. Seedlings will have to be planted, therefore, before 28 days after sowing in the mundakan season.

Table A.5. Influence of age of seedling on productive tillers per hill, flowering duration (days) and grain yield

Age group	Flowering duration (days)		Productive tillers/hill		Grain yield (kg/ha)	
	I Crop	II crop	I crop	II crop	I crop	II crop
21 days	101	97	5.7	6.8	5250	3140
28 days	98	96	5.4	6.1	5400	3150
35 days	95	97	5.7	7.0	5640	2720
42 days	91	83	5.5	6.1	4950	[illegible]40
CD (0.05)						356

Table 4.6. Grain yield as influenced by spacing (kg/ha)

Season	Spacing (cm)			CD
	15 x 10	15 x 15	15 x 20	(0.05)
I crop	5140	5400	5410	--
II crop	2920	2820	2810	--

Response of rice to microelements

The effect of micronutrients on the growth and yield of rice has not been studied in detail in Kerala. This is probably because difficiency symptoms are rarely observed under field conditions. Feeler trials conducted on cultivators' fields during the year 1972-73 at Kumbidi, Mannarghat, and Coyalmannam indicated low to moderate response to copper and molybedenum. In order to investigate the response of rice to microelements, an experiment was initiated in the virippu season of 1973-74, using the dwarf indica strain Aswathi as test variety.

The design of the experiment was randomized block with 3 replications. The treatments comprised of micro-elements alone and in combinations and secondary elements, calcium and magnesium (Table A.7). All the plots received a uniform dose of NPK at 90:45:45 kg per hectare.

The data on grain yield recorded during the first crop season did not reveal statistical significance between treatments indicating little response to micro and secondary nutrients (Table A.7). Slight depression on yield was observed in the treatment receiving iron as ferrous sulphate obviously because of its deleterious effect on the absorbing capacity of roots. The lateritic soil of the experimental plot also contained large proportions of iron. The treatment 14 which received all the micro and secondary nutrients registered the highest average yield.

The data on productive tillers per hill also revealed no marked difference between treatment effects.

During the second crop season, the crop was severely affected by drought at the flowering phase. Brown planthopper incidence was also severe. The plots receiving silica and copper were, however, observed to be comparatively free of brown hopper incidence, an observation which requires confirmation from future trials.

Table A.7. Grain yield and productive tillers per hill as influenced by different treatments

	Treatments	Rate of Application (kg/ha)	Form of nutrient	Productive tillers/hill	Grain yield (kg/ha)
1	Control (NPK)	--	--	6.1	4414
2	NPK + Iron	15	Fe So4	5.9	4064
3	NPK + Manganese	15	Mn S 4	6.1	4300
4	NPK + Zinc	15	Zn So4	6.4	4272
5	NPK + Copper	25	Cu So4	6.0	4329
6	NPK + Bromin	25	Borax	5.6	4376
7	NPK + Molybdenum	1.5	Amm.molybdate	5.4	4518
8	NPK + Silicon	40	Sod.silicate	5.5	4319
9	NPK + Calcium	500	Ca 0	6.0	4470
10	NPK + Magnesium	300	Mg So4	5.9	4225
11	NPK + all micronutrients		(as above)	5.7	442[illegible]
12	NPK + Calcium + Magnesium		(as above)	6.1	4518
13	NPK + Calcium + Magnesium + Silicon		(as above)	5.5	4376
14	NPK + Calcium + Magnesium + Silicon + all micronutrients		(as above)	6.1	4565
F (0.05)				NS	NS

Loss of plant nutrients in deep percolation

The main loss of plant nutrients from cultivated fields is through leaching. The magnitude of nutrient loss depends to a great extent on the edaphic and climatic factors. Since percolation is a natural phenomenon in soils, the chances of loss of nutrients through percolating waters are also very high. The extent of loss of major plant nutrients through deep percolation in rice fields was investigated in the present experiment.

The amount of water lost in evapotranspiration and percolation was estimated by the 'drum culture technique'. Water percolating below the root zone of rice plants was collected in perforated plythene tubes planted in the field and this water was syphoned out at intervals of 5 days for chemical analysis. Percolating water was thus collected from 2 adjacent plots of (17 x 17 m^2 each) uniform fertility, one receiving NPK at 100 : 50 : 50 kg, respectively, per hectare (as ammonium sulphate, super phosphate and muriate of potash) and the other receiving no fertilizer at all. Each plot had 4 polythene tubes for collecting percolating water.

Fluctuations in the ground water table was periodically measured using an observational well.

The test variety was Jaya, planted at a spacing of 15 x 15 cm.

The amounts of water lost in evapo-transpiration and percolation were measured for 97 days in the first crop season and 86 days in the second crop season.

Evapo-transpiration and percolation were estimated, respectively, as 4.88 mm and 3.91 mm per day in the first crop season and 7.32 mm and 7.99 mm per day in the second crop season (Table A.8). The total water requirement in the virippu season was, thus, 852.63 mm and in the mundakan season, 1316.66 mm. The loss of water in deep percolation was low in the first crop season, possibly due to high water table in that season, its fluctuation varying from 2 cm to 25 cm only. But in the second crop season, water table tended to receede as low as 78 cm below the ground level.

The magnitude of loss of all the major plant nutrients was high during the second crop season because of high rate of percolation. While the loss of N as ammonia was almost similar during the both seasons, loss of N as nitrate was far higher in the second crop season compared to that of the first crop season. The rate of loss of N as NH_2 was more, immediately after the application of ammonium sulphate as basal dressing or as top dressing.

The total loss of nitrogen from the manured plot was 31.49 kg/ha in the first crop season and 37.7 kg/ha in the second crop season. P_2O_5 and K_2O lost in percolation amounted, respectively, to 18.74 and 19.72 kg/ha in the first crop season and 28.24 and 58.62 kg/ha in the second crop season. The extent of loss of plant nutrients from the unmanured plot was 21.00, 14.4 and 13.65 kg/ha of N, P_2O_5 and K_2O respectively in the virippu season and 24.74, 28.02 and 46.60 kg of N, P_2O_5 and K_2O in the mundakan season. It is interesting to note that even after raising a crop without manuring, the soil continued to supply reasonable amounts of plant nutrients and the loss of nutrients in the second crop season was far higher than that in the first crop season.

In the first crop season the yield recorded was 4554 kg grain and 3730 kg of straw per hectare in the manured plot and 3120 kg of grain and 3152 straw per ha in the unmanured control plot. Grain and straw yields were considerably reduced during the second crop season, in spite of good crop management. The yield registered was 3515 kg of grain and 3286 kg of straw in the manured plot and 2180 kg of grain and 2136 kg of straw per hectare in the control plot.

Crop removal of N amounted to 90.27 kg /ha in the first crop season and 59.56 kg/ha in the second crop season from the plot manured with 100 kg N/ha. From the unmanured plot, N removal in the first and second crop seasons were, 56.52 and 28.84 kg/ha, respectively.

The study throws light on the magnitude of loss of nutrients from rice fields.

Table A.8. Loss of major plant nutrients from rice fields

Season	Percolation (mm)	Nutrient lost in percolation (kg/ha) from the manured plot				the unmanured plot			
		NH_3N	NO_3N	P_2O_5	K_2O	NH_3N	NO_3N	P_2O_5	K_2O
Virippu	379.27	19.35	12.14	18.74	19.72	11.13	9.87	14.40	13.65
Mundakan	687.14	18.55	19.24	28.24	58.62	10.31	14.43	23.02	46.6

Comparative yield trial of pre-release cultures

A trial was initiated in the first crop season of 1972-73 to compare the yield potential of pre-release rice cultures evolved at the Regional Research Stations, the Central station, and at the EPM Industrial and Agril. Estate, Ottapalam. This trial was continued during the year under report also.

The cultures were grouped into two: medium and early. Thease were tested under a common fertilizer schedule of 90:45:45 kg NPK per hectare in two separate experiments, the design being randomized block replicated 3 times. A common spacing of 20 cm x 15 cm was adopted for both the groups. The check varieties were IR.8 (medium) and Rohini (early).

Due to unfavourable weather conditions, the trial was abandoned during the second crop season and the data recorded during the first crop season only are reported.

Among the early duration varieties, excepting Culture-16 (Kayamkulam), all the cultures were at par in their yield potential with the check variety Rohini (Table A.9)

Table A.9. Grain yield (kg/ha) of early duration cultures

Culture/variety	Name of station	Flowering duration (days)	Grain yield (kg/ha)
1285	R.R.S Pattambi	82	3978
12053	R.R.S.Pattambi	75	4129
PVT.16	R.R.S. Kayamkulam	63	2913
202-1	R.R.S. Mannuthy	62	3453
203-1-1	R.R.S. Mannuthy	73	3904
10 x 1 x 1	R.R.S. Mannuthy	74	3904
Rohini (check)		65	4054

The yield data of the medium duration varieties were vitiated by bird damage.

AGRONOMIC RESEARCH CONDUCTED UNDER THE ALL INDIA COORDINATED RICE IMPROVEMENT PROJECT

Optimum seed rates for different methods of sowing

The 'Viripu' crop is either sown broadcast or dibbled immediately after a rain. In order to find out the optimum seed rates for these two methods of sowing, the present experiment was laid out using Thriveni as test variety. The seed rates adopted were 60, 90, 120, 150 and 180 kg/ha for broadcasting and 30, 50, 70, 90 and 110 kg/ha for dibbling at 20 cm x 10 cm spacing. The fertilizer schedule followed was 100 kg N, 60 kg P_2O_5 and 40 kg K_2O per hectare.

The crop was affected by blast during the early vegetative phase. The broadcast crop was the worst affected. Density of population was observed to have close association with the intensity of disease incidence. Higher the population per unit area, the more serious was the disease incidence. Two sprays with Hinosan, however, save the crop from this disease.

The data on grain yield (Table A.10) revealed no significant difference between seeding methods and the seed rates tried. Lower seed rate favoured the production of heavier panicles in the dibbled crop, but no marked difference was observed in the broadcast crop. A seed rate of 60 kg per ha. was found to be the optimum for broadcasting and 50 kg/ha for dibbling rice under semidry conditions.

Table A.10. The yield and other ancillary characters as affected by the methods of sowing and seed rates

Methods of seeding	Seed rate (kg/ha)	Grain yield (kg/ha)	Grain straw ratio	Panicle/sq.m (No)	Panicle wt. (g)	Days to 50% flowering (No)	Days to Maturity (No)
Broadcasting	60	3700	0.9[illegible]	504	1.52	71	101
	90	3686	0.95	491	1.54	70	1[illegible]
	120	3585	0.98	518	1.29	69	99
	150	3442	0.95	555	1.14	63	98
	180	3466	0.89	631	0.87	67	98
	Mean	3595	0.93	540	1.27	69	99
Drilling	30	2674	1.04	439	1.78	72	102
	50	3819	0.76	475	1.60	71	101
	70	3698	0.78	461	1.61	71	100
	90	3708	0.77	494	1.49	69	99
	110	3628	0.74	554	1.37	69	99
	Mean	3705	0.82	485	1.57	70	100

Nitrogen responsiveness of early duration rice under direct seeding

The object of this investigation was to assess the yield potential of early duration rices under different levels of nitrogen. The varieties were Cauvery, Bala, IET 1983, 2913, 2914 and Thriveni. The levels of Nitrogen were 0, 50, 100, 150 and 200 kg/ha. The varieties were tried in whole plots and nitrogen levels in sub plots in a split plot design. The crop was direct seeded under flooded conditions at seed rate of 100 kg/ha. A common dose of 80 kg P_2O_5 and 50 kg K_2O was given as basal dressing at sowing.

The local choice, Thriveni proved significantly superior to the other varieties in yield potential. Bala ranked second. It was, however, on a par with Cauvery (Table A. 11). The other varieties ranked in the following order Cauvery, IET 2914, IET. 2913, IET. 1983. Among these 6 varieties, Bala and Thriveni only were found to be nitrogen responsive, with the former showing linear response up to 200 kg N/ha. Thriveni, exhibited higher yield potential even under no nitrogen manuring, the mean yield being 2579 kg/ha for Thriveni and 1746 kg/ha for Bala. Thriveni at 50 kg/ha N yielded more than Bala at 100 kg/ha. The rate of response to nitrogen, however, was relatively more for Bala than for Thriveni. Both these varieties are quite suitable for direct seeding under wet conditions.

Table A. 11. **The summary of grain yield**

Variety	N level (kg/ha)	Grain yield (kg/ha)	Variety	N level (kg/ha)	Grain yield (kg/ha)
Cauvery	0	2084	Bala	0	1746
	50	2956		50	2249
	100	3379		100	3665
	150	3272		150	3949
	200	2828		200	4414
	Mean	2828		Mean	3205
IET 1983	0	2000	IET 2914	0	1691
	50	3114		50	2435
	100	3184		100	3309
	150	2482		150	3242
	200	1456		200	3297
	Mean	2447		Mean	2795
IET 2913	0	1281	Thriveni	0	2579
	50	2193		50	3877
	100	2860		100	4298
	150	3228		150	4500
	200	3193		200	4105
	Mean	2551		Mean	3672

C.D. (0.05)	Between varieties	405
	Between N levels	298
	N.Level (Same V)	731
	Varieties (same N)	768

Weed control in direct seeded rice

Weed control in direct seeded flooded rice fields involves high cost. Trials conducted in the previous years have revealed that chemical weed control was cheaper than the traditional method of hand weeding. The relative efficacy of new herbicides on the control of weeds in direct seeded flooded rice fields was investigated during the viripoo season of 1973-74

The treatments comprised of 8 herbicides, one unweeded control and one hand weeding. The design of the experiment was randomized block in 5 replications (Table A. 12). The test variety was Jaya, sown broadcast at 100 kg per ha. The NPK schedule followed was 100 kg N, 60 kg P_2O_5 and 50 kg K_2O per hectare.

Visual rating on toxicity to rice done on the 7th day after the application of herbicides showed that Machete at 1.0 kg a.i./ha was the least toxic. At 1.5 kg/ha it exhibited mild scorching of leaves. Saturn was similar to Machete at the 1.5 kg/ha level on its reaction on young rice seedlings. The other herbicides ranked in the following order in the intensity of toxicity to rice. C. 288 Tavron G C.19490 Ronstar Propanil. The initial rating on weed control recorded on the 30th day after sowing revealed that C. 288, Ronstar, Machete, Tavron G, Saturn and Propanil were quite effective on weed control.

Hand weeding turned out to be the best treatment producing a mean grain yield of 3557 kg/ha. It was, however, on a par with Ronstar and C. 288 which recorded 3144 and 3312 kg/ha, respectively. Propanil, Machete (1.5 kg/ha), and Saturn also showed [illegible] promise as weedicides for direct sown rice.

Table A.12 Ratings on toxicity and weed control, grain yield of rice and dry matter of weeds at harvest as influenced by different treatments

Treatment	Rate of applica-tion. (kg. ai/ ha)	Time of appli cation (DAS)	Rating on to-xicity (15 DAS)	Rating on weed control (30DAS)	Grain yield (kg/ ha)	Dry mat ter of weeds (kg/ ha)
Saturn	1.5	6	1.5	1.6	2675	1560
Machete	1.0	6	1.0	1.1	2027	[illegible]
Machete	1.5	6	1.4	1.3	2633	1506
Tavron G	0.5					
	0.4	10	2.2	1.5	2246	[illegible]33
C.288	1.0	6	2.2	1.0	3312	1[illegible]06
C.19490	1.0	6	2.5	2.1	2420	[illegible]
Ronstar	1.0	6	2.0	1.0	3144	4[illegible]0
Hand weeding (twice)				1.0	3557	[illegible]
Unweeded control				5.0	1533	2540
Stam F. 34 (Propanil)	3.0	20	1.75	1.4	2340	11[illegible]
CD (0.05)					494	

1 = no toxicity or excellent weed control
5 = high toxicity or no control of weeds
DAS = days after sowing

Time of application of nitrogen for transplanted rice

Various factors influence the proper timing of nitrogen application. Of these, the most important are, the soil condition, duration of the variety and the source of nitrogen. The efficiency of nitrogen, as affected by different sources, times and rates was investigated for a short duration rice variety under transplanted conditions in this trial.

The sources of nitrogen were, ordinary urea, sulphur coated urea and shellac coated urea. All these sources were compared at a common level of 100 kg N/ha applied at planting. Urea was also applied in splits to study whether the slow release sources would compare well with the split application of nitrogen.

The test variety was Rohini, transplanted at a spacing of 20 cm x 10 cm with 2 seedlings/hill. A basal dose of 60 kg P_2O_5 and 40 kg K_2O was also given to all the plots at planting. The trial was conducted during the virippu and mundakan seasons.

Application of nitrogen in 3 or 4 splits as in treatments 14,13 or 15 registered significantly higher yields over the treatment receiving all the nitrogen as ordinary urea at planting as in treatment 2 (Table A. 13). The slow release source of nitrogen i.e. sulphur coated urea was, however, at par with treatments 14, 13 and 15 indicating that it was a better source of nitrogen for transplanted rice compared to ordinary urea. The increase in yield recorded by sulphur coated urea over the ordinary urea was 8.9 per cent on equal nitrogen basis. The magnitudes of increase in yield on account of split application of nitrogen as in treatment 14 over ordinary urea and sulphur coated urea were, respectively, 11 and 2 per cent. Shellac coated urea was not as effective as sulphur coated urea. This investigation also indicated that application of a small portion of nitrogen (25kg/ha) at the booting stage would bring about marked increase in grain production.

The trial was repeated during the mundakan season also. The results were vitiated due to severe incidence of brown planthopper. Hence the data are not presented in this report.

Table A.13. Grain yield of Rohini rice as influenced by the time of application of nitrogen

	Rate and time of nitrogen application					Grain yield (kg/ha)
	Total N (kg/ha)	At planting (kg/ha)	At Tillering (kg/ha)	At Panicle initiation (kg/ha)	At booting (kg/ha)	
1	--	--	--	--	--	3445
2	100	100 $	--	--	--	4372
3	100	100 $	--	--	--	4761
4	100	50 $	25	25	--	4787
5	100	75 $	--	25	--	4507
6	100	100 *	--	--	--	4394
7	100	75	25	--	--	4285
8	100	75	--	25	--	4639
9	100	75	--	25F	--	4464
10	100	75	25F	--	--	4337
11	100	75	--	--	25	4534
12	100	50	25	25	--	4569
13	100	50	--	25	25	483
14	100	50	25	--	25	4858
15	100	25	25	25	25	4691
CD (0.05)						269

$ = Sulphur coated urea
* = Shellac coated urea
F = Foliar spray

Varietal response to nitrogen

Response of pre-release rice varieties belonging to early and medium duration groups to nitrogen was investigated during the mundakan season in 2 separate experiments. The early duration varieties were IET 849, IET 2233, IET 2508, IET 1552, Palman 579 and Tella Hamsa. Ratna and Thriveni were the check varieties. In the medium duration group , the varieties tried were. IET 2254, IET 2885, IET 1996, IET 1991, IET 2295, IET 1309, culture 6473 (local choice) and Jaya (check variety).The levels of nitrogen were 0, 40, 80, 120 and 160 kg/ha. The design of the experiment was split plot with varieties in the whole plots and nitrogen levels in the sub plots. Both the trials were transplanted at a spacing of 20 cm x 10 cm. The fertilizer schedule included in addition to nitrogen, P_2O_5 and K_2O at 80 and 40 kg each per hectare.

Immediately after the flowering stage, incidence of brown planthopper occured in a devastating form and the crop could not be saved completely from this pest. It was observed that the intensity of incidence was more in the plots receiving higher doses of nitrogen. The only variety that withstood the pest attack was Thriveni. It has exhibited field tolerance to brown planthopper in other trials also.

The data on grain yield are presented in Table A.14. These data, however, do not represent the true yield potentials of the varieties tried.

Table A.14. Grain yield (kg/ha) of early and medium duration rices as influenced by the rate of nitrogen applied

Variety	Nitrogen applied (kg/ha)				
	0	40	60	80	120
Early duration group					
Ratna	1322	1766	1909	1672	1728
IET 2508	1380	1865	1853	1940	1386
IET 1522	1417	1517	1616	1399	1001
IET 849	1449	1585	1728	2195	1666
Palman 579	1648	1996	1610	1949	1871
Tel.Hamsa	1380	1616	1784	1461	1716
IET 2233	1281	1666	1361	1200	1473
Thriveni	2276	2599	2524	2238	2487
Medium duration group					
IET 2254	2349	2650	1771	3082	3363
IET 2385	1777	2464	2929	2555	2389
IET 1996	1892	2444	2580	2670	2570
IET 1991	1290	1636	1681	1807	1687
IET 2295	1480	1772	1962	2048	1847
IET 1039	1581	1982	1827	2143	1932
Cul 6473 (Sabari)	1275	1912	1646	1728	1721
Jaya	1631	1917	2449	2540	2319

Management of nitrogen under resource constraints

Nitrogen is in limited supply. Therefore, considerable economy has to be exercised in its use. How far the efficiency of nitrogen can be increased under a low level nitrogen application? This formed the object of the present investigation conducted during the ' mundakan ' season using Jaya as test variety. The treatments included different source of nitrogen such as ordinary urea, shellac coated urea, sulphur coated urea and neemcake blended urea, different rates and timings of application. The design of the experiment was randomised block in 4 replications.

The crop was affected by drought after flowering. Hence it is doubtful whether the data (Table A.15) represents the true effects of treatments.

Split application of nitrogen invariably yielded higher returns compared to single application at planting. However, the differences were not statistically significant. Similarly, the slow release source of nitrogen i.e. sulphur coated urea, was only slightly superior to ordinary urea, the percentage of increase being 1.87. The other slow release sources were observed to be inferior, though not significantly, to ordinary urea. This may be because the treatments would not express their effect on yield on account of drought conditions in the field.

Table A.15. Grain yield (kg/ha) as affected by different treatments.

Treat-ment No.	Nitrogen applied (kg/ha) Total N	at planting	at tillering	7 days before panicle initiation	at panicle initiation	Grain yield
1	--	--	--	--	--	2235
2	50	50	--	--	--	2875
3	50	50 *	--	--	--	[illegible]
4	50	50 @	--	--	--	28[illegible]1
5	50	50 $	--	--	--	2747
6	50	25 *	--	25	--	31[illegible]
7	50	--	50	--	--	2771
8	50	--	--	50	--	3118
9	50	--	25	25	--	313[illegible]
10	50	--	25	--	25	29[illegible]
11	50	25	25	--	--	2777
12	50	25	--	25	--	2899
13	50	25	--	12.5	12.5	3136
14	50	12.5	25	--	12.5	25[illegible]4
CD (0.05)						370

* = Sulphur coated urea
@ = Shellac coated urea
$ = Neemcake coated urea

CHEMISTRY

Permanent manurial trials revealed that a combination of organic and inorganic manures was the best manurial schedule for both the tall and dwarf *indica* rices.

Trials with lignite fly ash showed that it was a good substitute for lime.

Physiologic trials brought to light that yield was directly related to leaf area index

Permanent Maurial Trial (Tall indica series)

The experiment to study the effect of continuous application of green leaf, cattle manure, Ammonium sulphate and their combination with and without P_2O_5 and K_2O on yield of a tall indica rice variety and on soil properties, commenced in 1962, was continued during the year. The design adopted was RBD with 4 replications. Ptb.2 and Ptb. 20 were the test varieties for viripou and mundakan seasons respectively. Organic manures, P and K were applied as basal and Ammonium sulphate was applied as top dressing one month before flowering. The total NPK level given was 40 . 20 : 20.

The yield data are given in table C.1.

The results of the viripou season showed statistically significant differences in yield due to treatments. The difference in yield between treatments getting 8000 lb. organic manure and NPK @ 20 : 20 20 as fertilizer was not significant. These treatments proved significantly superior to those getting inorganic fertilizers alone.

Table C.1 Grain yield as influenced by different treatments

Tr. No.	Treatments	Grain yield (kg/ha) Virippu	Mundakan
1	Cattle manure @ 8000 lb/acre	3008	3760
2	Green leaf @ 8000 lb/acre	2462	3084
3	Cattle manure @ 4000 lb + green leaf @ 4000 lb/acre	2840	3950
4	Ammo. sulphate to supply 40 lb.N/acre	2313	2908
5.	Cattle manure @ 4000 lb + Ammonium sulphate to supply 20 N/acre + superphosphate to supply 20 lb P_2O_5 + 20 K_2O	2863	3633
6	Green leaf @ 4000 lb/acre + NPK @ 20:20:20	2367	3246
7.	Cattle manure 2000 lb + green leaf 2000 lb + NPK @ 20:20:20	2583	3530
8	NPK @ 40:20.20 lb/acre	2435	3125
	CD (0.01)	520.8	

Among the organic manures, cattle manure gave higher yield than green leaf.

During the mundakan season, yield differences due to treatments were not significant statistically.

Soil analysis data after the harvest of rabi crop revealed high percentage of organic carbon and available potash in plots receiving cattle manure @ 8000 lb/acre. Pore space and moisture holding capacity were maximum in these plots, while maximum bulk density was observed in plots receiving inorganic fertilizers.

Permanent manurial trial (dwarf indica series)

The aim of the experiment and the design adopted were the same as the previous one. As, Jaya- a dwarf indica variety was used, the NPK level adopted was 90 45.45 given solely as organic and inorganic or in their combination.

Organic manures, potash and half the dose of nitrogen were applied as basal and the other half of nitrogen as top dressing at panicle initiation.

The yield data are presented in Table C.2.

During the virppu season a combination of organic and inorganic manures gave significantly higher yield over the treatments getting either organic or inorganic alone. Tr.5, 6 and 7 were on par and were superior to all the other treatments.

In the mundakan season, the yield differences due to treatments were not statistically significant

Table C.2. Grain yield of ' Jaya ' rice as influenced by the different treatments in the permanent manurial trial

Tr. No.	Treatments	Yield of grain (kg/ha)	
		Viruppu	Mundakan
1	Cattle manure @ 18000 kg/ha to supply 90 kg N/ha	3710	2107
2	Green leaf @ 18000 kg/ha to supply 90 kg N/ha	3550	2181
3	Cattle manure @ 9000 kg/ha + green leaf @ 9000 kg/ha	3653	2363
4	Ammonium sulphate to supply 90 kg N/ha	3751	2379
5	Cattle manure @ 9000 kg/ha + NPK @ 45.45.45	4232	2239
6	Green leaf @ 9000 kg/ha + NPK @ 45:45 45	3864	2[illegible]35
7	Cattle manure @ 4500 kg/ha + green leaf 4000 kg/ha + NPK @ 45 45:45	4302	2356
8	NPK @ 90:45:45 in inorganic form	3688	410
	CD (0.01)	449.8	

Foliar nutrition of upland rice

The effectiveness of applying urea as foliar spray on a dry sown crop of Taichung (Native)I was studied in this experiment The design adopted was RBD with 9 treatments and 3 replications (Table C.3).

The results revealed no statistical significance between treatments. However, the trend of the results favoured a combination of soil plus foliar application.

Table C.3. Grain yield as influenced by the rate and method of N application in the uplands.

Tr. No.	Treatment particulars			Grain yield (kg/ha)
1	45 Kg	N/ha	complete soil	645
2	45 kg	,,	soil + foliar	692
3	45 kg	,,	complete foliar	682
4	65 kg	,,	complete soil	682
5	65 kg	,,	soil + foliar	708
6	65 kg	,,	complete foliar	515
7	85 kg	,,	complete soil	619
8	85 kg	,,	soil + foliar	625
9	85 kg	,,	complete foliar	322
CD (0.05)				...

Foliar nutrition of low land transplanted rice

Response of low land transplanted rice to foliar nutrition of nitrogen was investigated in this experiment. The treatments included 3 levels of N (45, 65, 85 kg/ha) and 2 methods of application- soil and foliar (Table C.4). The test variety was Jaya, transplanted at a spacing of 20 cm x 10 cm with 2-3 seedlings per hill. Phosphorus and potash were applied at 45 kg each per hectare at planting.

During both the seasons, the results were not statistically significant. Kharif seasons result showed highest yield in the treatment getting 85 kg N/ha as soil + foliar, where-as rabi season's result showed that treatment gettin 65 and 85 kg N/ha as soil application was better.

The yield data are presented in Table (C.4)

Table C.4. Grain yield as affected by the rate and method of nitrogen application in transplanted rice

Tr. No.		Treatments	yield (kg/ha) Viri-ppu	Mandakan
1	45 kg N/ha	Soil ($\frac{1}{2}$ basal + $\frac{1}{2}$ top dressing)	4991	2295
2	45 kg ,,	$\frac{1}{2}$ soil + $\frac{1}{2}$ foliar	4598	2349
3	45 kg ,,	complete foliar - 2 doses	4925	2125
4	65 kg ,,	Soil (basal + $\frac{1}{2}$ top dressing)	5016	2636
5	65 kg ,,	$\frac{1}{2}$ soil + $\frac{1}{2}$ foliar	4575	2285
6	65 kg ,,	foliar- in two doses	4466	2051
7	85 kg ,,	Soil ($\frac{1}{2}$ basal + $\frac{1}{2}$ top dressing)	5150	2625
8	85 kg ,,	$\frac{1}{2}$ soil + $\frac{1}{2}$ foliar	5366	2434
9	85 kg ,,	foliar- in two doses	4766	2189
F (0.05)			NS	NS

Lignite fly ash trial

Lignite fly ash, a by-product of Neyveli Lignite Corporation, contains CaO and Mg.O. In order to find out its utility as a liming material, this trial was initiated in 1969. Commonly used liming materials like burnt lime and dolomite were used as control. The variety used during both the seasons was IR.8. Design adopted was RBD with 5 replications (Table C.5)

There was no marked change in the soil pH by adding lignite flyash and it was very similar to lime or dolomite in its effect on soil pH. The lignite fly ash applied plots gave the maximum grain yield, as in previous seasons followed by the treatment receiving dolomite.

Table C.5. Grain yield as affected by different liming materials

Tr. No.	Treatment	Yield (kg/ha) Grain	Straw
1	No lime	4079	5335
2	Burnt lime 250 kg/ha	3965	5551
3	Dolomite 400 kg/ha	4090	5772
4	Lignite fly ash 1660 kg/ha	4102	5784
F (0.05)		NS	NS

PHYSIOLOGY TRIALS UNDER THE ALL INDIA COORDINATED RICE IMPROVEMENT PROJECT

Leaf area index trial

To understand the inter-relationship between leaf area index (LA I) at flowering and yield and yield components, this experiment was laid out during the viripou season. The design adopted was split plot with two nitrogen levels (100 kg and 200 kg) as major treatments and 5 spacings (10 x 10 cm, 20 x 20 cm, 30 x 30 cm, 50 x 50 cm and 100 x 100 cm) as minor treatments.

Observations on leaf area index and total dry weight at flowering, total dry weight, yield and yield components at harvest were made. Summary of observations recorded are given in Table C.6.

Table C.6. Grain yield and ancillary characters as affected by nitrogen and spacing

Treatments	Leaf area index at flowering in cm^2 x cm^2 of land	Productive tillers per hill	Dry Wt. at harvest per hill (gm)	Grain yield/ M^2 (gm)	100 grain wt. (gm)
Nitrogen 100:-					
10 x 10 cm	11.35	3.82	15.85	519.28	19.9
20 x 20 cm	8.69	11.57	44.11	480.31	[illegible]
30 x 30 cm	4.00	21.68	91.08	448.36	18.9
50 x 50 cm	3.83	50.69	187.84	259.77	18.0
100 x 100 cm	0.99	58.90	234.67	86.60	17.2
Nitrogen 200.-					
10 x 10 cm	14.50	4.06	13.11	407.63	18.7
20 x 20 cm	9.37	13.95	[illegible]	338.32	[illegible]
30 x 30 cm	5.73	19.97	[illegible]	305.65	18.8
50 x 50 cm	3.05	48.54	162.40	285.32	[illegible]
100 x 100 cm	1.20	65.85	263.22	93.39	17.7

The maximum leaf area index at flowering was obtained when 10 x 10 cm spacing was adopted. The yield was seen directly related to leaf area index. There was an increase in leaf area when nitrogen level was increased. Wider spacing resulted in decrease of leaf area, increase in dry weight and increase in tiller production per hill. The yield for unit area for wider spacing was less.

Shading experiment

This experiment was conducted during both the virippu and mundakan seasons, to study the influence of shading (low light intensity) on growth, yield and yield components. Split plot design was adopted with varieties (Vijaya (VI) and Sona (V2) as major treatments and shading treatments as minor treatments. Shading treatments were (SI) shading from transplanting to necknode differentiation (S2) shading from neck node differentiation to flowering (S3) shading from flowering to harvest and (S4) no shading (control).

The yield data gathered at the 3 stages for the two seasons are presented in Table C.7 and 8 and 9

Table C.7. Observation at Ist stage (necknode differentiation)

Treatment		Mean No. of tillers per hill		Mean height of hills (cm)		Mean dry wt. of hills (g)	
		Virippu	Mundakan	Virippu	Mundakan	Virippu	Mundakan
VI	SI	9.00	5.95	72.25	81.45	9.78	4.85
VI	S2	15.97	9.95	64.72	71.02	1[illegible].78	7.02
VI	S3	16.14	10.00	66.57	74.27	17.20	11.4[illegible]
VI	S4	13.77	13.22	63.10	7[illegible].72	13.[illegible]9	1[illegible].06
V2	SI	8.80	6.55	72.65	87.37	7.[illegible]5	4.70
V2	S2	16.06	10.87	68.51	70.62	21.46	[illegible].36
V2	S3	14.67	11.40	65.10	68.77	15.30	[illegible].30
V2	S4	15.56	14.02	62.30	67.22	19.63	[illegible].00

Note: VI = Vijaya V2 = Sona

Table C.8. Observation at second stage (at flowering)

Treatment		Total tillers		No. of spikelets/ panicle		Mean dry weight per hill (g)	
		Virippu	Mundakan	Virippu	Mundakan	Virippu	Mundakan
VI	SI	13.85	7.01	170.47	12[illegible].67	30.13	12.[illegible]
VI	S2	11.92	10.61	126.95	107.35	23.36	1[illegible].39
VI	S3	12.40	12.72	173.02	172.37	37.41	10.02
VI	S4	12.05	11.92	180.17	157.97	36.59	2[illegible].[illegible]
V2	SI	13.75	9.00	177.35	178.10	28.51	12.61
V2	S2	12.26	12.40	135.15	137.55	22.18	12.04
V2	S3	12.87	16.43	186.62	175.50	34.88	14.83
V2	S4	13.31	15.09	180.90	175.40	34.28	16.16

Table C.9. Observation at 3rd stage (at harvest)

Treatments		Yield of grain (GM)		No.of panicles/ hil		100 grains Wt. (G)	
		Viri-ppu	Munda-kan	Viri-ppu	Munda-kan	Viri-ppu	Munda-kan
VI	SI	19.01	14.80	10.56	8.07	22.42	21.89
VI	S2	14.32	14.32	9.71	9.55	22.36	23.21
VI	S3	12.60	10.850	10.51	8.26	20.76	19.68
VI	S4	20.77	21.30	10.76	9.47	21.54	21.06
V2	SI	18.77	17.39	12.65	9.05	19.05	18.05
V2	S2	14.19	14.53	10.85	8.41	19.90	16.30
V2	S3	15.41	14.04	10.02	11.66	18.59	15.55
V2	S4	26.75	13.99	11.84	11.82	19.20	16.52

It is seen that shading the plants during early stages of growth, i.e. till neck node differentiation reduces the number of tillers and dry weight. Height tended to increase when shaded. Flowering duration is reduced by 1 week when the plants are shaded in the first stage.

Shading at second stage and third stage, reduces productive tillers/hill, dry weight, number of spikelets per panicle and grain yield when compared to the control. The reduction in dry matter is due to reduction in photosynthesis. It is also seen that plants shaded in their early stages recoup from the adverse effect when shade is removed during the subsequent stages of growth.

Growth analysis trial

This experiment was conducted only during the Mundakan season to study the growth pattern in relation to production efficiency of some pre-release types. Design adopted was split plot with 2 nitrogen levels (100 and 200 kg N/ha) as major and 18 cultures as minor treatments

Varieties/cultures.

Early types	Mid types	Late types
1. Pusa-2-21	7. CR-12-175	14. CR-137-44-20
2. IET. 2223	8. IET. 1991	15. CR. 137-36-1
3. IET. 349	9. RP. 39-40-2	16. CR. 195-1
4. IET. 2508	10. IET. 1039	17. CR. 270-4 -4
5. RP. 29-73	11. RP-4-2	18. Jagannath
6. Cauvery	12. RP. 4-14	
	13. Jaya	

Spacing adopted was 20 x 15 cm. P_2O_5 and K_2O were applied @ 100 kg/ha as basal.

Observation on leaf area index at primordial initiation and heading, height measurement and tiller No. at all stages and yield and yield components were recorded.

It was found that at the higher level of nitrogen i.e. 20 kg/ha, plant height, tiller number, leaf area, and dry matter content were more than those at the lower level i.e. 100/ha. But panicle number and number of filled grains per panicle were more at the low N level. Dry weight, tiller number and yield were more in mid and late types than in early types.

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Research on the control of major rice pests was intensified during the year. Ekalux G and Phosvel EC were rated as highly effective against gall midge. Carobofuran (Furadan 3 g) proved to be the best chemical for the control of brown planthopper which occured in a devastating form during the year.

Sprays in general were found to be most effective in controlling leaf folder than granular insecticides. However Galecron followed by Furadan among the granular insecticides was found to control the pest.

Studies on the epidemiology of rice pests showed that the incidence of gall midge was related to high rainfall and low temperature. The maximum infestation of gall midge occurred in the second fortnight of June. Stem borer incidence had two peaks- one in the first fortnight of October and the other in the second fortnight of December.

Screening of New Insecticides

The object of the experiment was to evaluate the effectiveness of potential chemicals at specific intervals on the control of rice pests.

This trial was initiated during first crop season 1972-73, and was continued during both the seasons of 1973-74. Nineteen insecticides, 12 in the form of emulsifiable concentrates and 6 in the form of granules, with an untreated control formed the treatments. The design of the experiment was randomised blocks with 2 replications. The test variety was Jaya. The emulsifiable concentrates were sprayed 5 times at intervals of 15 days starting from the 10th day after planting and the granules applied (three times) on the 10th, 30th and 60th day after planting. The results of the first crop trial are furnished in Table E.1.

Table E.I. Effect of insecticides on pest incidence

Sl No.	Chemical		Dose in kg/ha	Mean incidence of Silver shoot	Mean incidence of Dead heart	Mean yield (kg/ha)
1	Phosvel	EC	0.5	4.5	3.3	6289
2	Birlane		"	13.0	2.5	5060
3	Bidrin	"	"	12.0	2.1	5507
4	Phosalone			9.9	5.8	5003
5	Anthio	"	"	11.0	4.0	5010
6	Ekalux	"		9.0	4.4	5010
7	Ambithion			14.5	5.8	5603
8	Dursban	"		0.6	1.2	4100
9	Lebaycid	"		12.8	3.0	5507
10	Dimecron		"	11.6	3.1	6050
11	Nuvacron			11.0	2.6	5307
12	Mipsin			9.9	7.3	5430
13	Cytrolane	G	1.5	8.5	2.0	5463
14	Birlane		"	15.2	3.1	5400
15	Furadan	"	1.0	10.4	3.0	5600
16	BHC		1.5	15.4	4.5	4500
17	Ekalux			1.8	2.1	5076
18	Diazinon			11.1	2.5	4934
19	Parathion	EC	0.4	11.8	1.5	5459
20	Untreated control			17.0	14.4	4570
C.D(0.05)				4.16	5.29	NS

Control of Gall fly

The incidence of silvershoot ranged from 1.8% in plots treated with Ekalux G to 17.0% in the untreated control. The treatments were statistically significant. Ekalux G and Phosvel were on par in their effect on the control of gall midge.

Control of Stem-borer

The early brood of stem borer causing deadhearts was present. The mean incidence of deadhearts varied from 1.2% to 14.4%. The treatments were statistically significant. Dursban EC, Parathion EC, Ekalux G and Bidrin SC, Diazinon G and Birlane SC, Nuvacron EC, Cytrolane G- Lebaycid, Furadan G, Birlane G and Dimecron, and Phosvel EC were on par in their effect. The white ear incidence was practically nil in all the above treatments.

Grain yield

The yield differences were not significant. The maximum yield of 6289 kg/ha was recorded by Phosvel, which was closely followed by Ekalux G and Dimecron, recording 6076 kg and 6050 kg/ha, respectively.

During second crop season the attack of gall fly and stemborer was not as severe as in the first crop season. But after earhead emergence, there was an attack of leaf-roller followed by heavy incidence of brown planthopper. The results are presented in Table E.2.

Table E.2. Incidence of pests in the different treatments

Tr. No.	Chemical		Dose a.i kg/ha	Incidence of Silver shoot %	Incidence of Dead heart %	Area of hopper burn (%)	Yield (kg/ha)
1	Phosvel	EC	0.5	1.8	2.6	0	4264
2	Birlane	"	"	1.0	3.5	7.5	3944
3	Bidrin	"	"	2.2	5.3	0	4104
4	Phosalone	"	"	2.4	3.3	12.5	3326
5	Anthio	"	"	2.7	2.9	95	1151
6	Ekalux	"	"	3.2	3.0	25	3017
7	Ambithion	"	"	1.3	2.3	28	3963
8	Dursban	"	"	1.5	2.0	0	4136
9	Lebaycid	"	"	1.8	2.3	0	3944
10	Dimecron	"	"	2.1	2.8	0	3763
11	Nuvacron	"	"	2.7	2.4	0	3656
12	Mipsin	"	"	2.5	4.9	0	4083
13	Cytrolane	G	1.5	1.0	2.2	95	1790
14	Birlane	"	"	2.6	2.5	97	1524
15	Furadan	"	1.0	2.4	3.1	0	4136
16	BHC	"	1.5	2.6	3.2	100	458
17	Ekalux	"	"	2.1	2.7	93	2537
18	Diazinon	"		3.7	2.3	90	2132
19	Parathion	"	0.4	2.2	1.0	62	2010
20	Control			4.5	5.9	100	1543
	C.D.			NS	NS		1023

Control of gall fly

The incidence of silvershoot was less than compared to the first crop ranging only from 1.0 to 4.5 % . The treatment differences were not significant. The lowest incidence of silvershoot was recorded in treatments Birlane EC and Cytrolane G.

Control of stem borer

The incidence of deadhearts was less when compared to the first crop, the highest being 5.9% in the untreated control. The treatment differences were not significant. Lowest incidence (1.0%) was recorded by Parathion followed by Dursban EC (2.0%). As in the first crop, the incidence of white earheads was practically nil.

Leaf roller

Incidence of leaf roller was noticed only in plots treated with Birlane G, B.H.C. G, Diazinon G and the untreated control. All the other treatments were free of leaf roller attack.

Control of brown planthopper

Heavy incidence of brown planthopper resulted in hopper burn in some of the treatments. An estimate of the efficacy of the different chemicals was done on the basis of area affected by hopper burn and the grain yield. Phosvel, Bidrin, Dursban, Lebaycid, Dimecron, Nuvacron and Mipcin among the emulsifiable concentrates and Furadan among granules were not affected by hopper burn. Varying degree of hopper burn ranging from 7.% to 100% occured in other treatments.

Grain yield

The wide difference in the grain yield was due to brown planthopper attack. Analysis of data showed significant difference between treatments. Phosvel, Dursban, Furadan 3 G, Birlane, Mipcin, Birlane, Lebaycid, Dimecron, and Nuvacron were on par. The lowest grain yield was recorded by B.H.C. treated plot i.e. 458 kg/ha as against 1545 kg/ha in the untreated control. This was because of the activity of the predator Coccinella arcuata F in the untreated control. The predators were completely destroyed in the plots treated with B.H.C. granules.

Insecticide trial

The object of the experiment was to study the efficacy of insecticides on the control of major pests of rice.

There were 16 treatments, including an untreated control. The chemicals were applied three times, granules 10 days after planting, and spray fluids 30 and 50 days after planting. The details of the treatments are given below. The experiment was laid out in a randomized block design with 16 treatments and 2 replications, using Jaya as test variety. This experiment was conducted during both the first and second crop seasons. The results of 1st crop trial are furnished in Table 3.5.

Treatments

Tr. No.	Insecticides 10 DAT (kg/ha)		30 DAT (%)		50 DAT (%)	
1	Ekalux G.	1.5	Ekalux EC	0.25	Ekalux EC	0.25
2	Ekalux G.	0.75	Ekalux EC	0.25	Ekalux EC	0.25
3	Birlane G	1.5	Birlane EC	0.25	Birlane EC	0.25
4	Birlane G	0.75	Birlane EC	0.25	Birlane EC	0.25
5	Cytrolane G	1.0	Ambithion EC	0.25	Ambithion EC	0.25
6	Cytrolane G	0.5	Ambithion EC	0.25	Ambithion EC	0.25
7	Furadan G	1.0	Furadan WP	0.25	Furadan WP	0.25
8	Furadan G	0.5	Furadan WP	0.25	Furadan WP	0.25
9	Galecron G	1.5	Dimecron	0.25	Dimecron	0.25
10	Galecron G	0.75	Dimecron	0.25	Dimecron	0.25
11	Folithion F	1.5	Folithion EC	0.25	Folithion EC	0.25
12	Folithion F	0.75	Folithion EC	0.25	Folithion EC	0.25
13	ENF 3467	0.5	ENF 3467	0.5	ENF 3467	0.5
14	ENF 3467	0.25	ENF 3467	0.5	ENF 3467	0.5
15	Parathion	0.25	Parathion	0.25	Parathion	0.25
16	Untreated control					

DAT = days after planting.

Table E.3. Silvershoot, dead heart counts and grain yield

Tr. No.	Silver shoot	Dead heart	Yield (kg/ha)
1	2.4	3.8	5852
2	4.7	2.1	5600
3	4.0	4.1	6076
4	5.3	3.1	5992
5	1.3	3.4	5880
6	2.4	3.6	5572
7	3.7	1.8	5824
8	4.5	3.3	5628
9	2.7	2.6	6216
10	6.4	1.8	6020
11	4.2	2.0	6020
12	9.0	2.0	5712
13	2.4	4.4	5824
14	5.2	4.1	5572
15	3.1	1.9	5492
16	9.8	3.4	4844
C.D.	NS	NS	594

Control of gallfly

Data on the incidence of silvershoot were taken at 30 days after planting and 50 days after planting. The incidence at 30 DAT was negligible. There was no significant difference between treatments with regard to incidence of silvershoot. But the lowest incidence was recorded in treatment No. 5 followed by 6,1 and 13.

Control of stemborer

The incidence of deadhearts ranged from 1.8 to 4.1%. There was no statistical significance between insecticides, however, Lowest incidence was recorded in treatments 7 and 10.

Grain yield

The treatments 9,3,10 and 11, 4 and 15,5,1,7 and 13, 12 and 8 are statistically significant and on par with regard to grain yield.

The experiment was continued during the second crop season also. In addition to the incidence of silvershoot and deadhearts there was high incidence of brown hopper towards the last phase of crop growth. Hence the efficiency of chemicals were evaluated against brown planthopper (Table 3.4).

Table 3.4. Pest incidence and yield as influenced by different insecticides.

Tr. No.	Silver shoot (%)	Dead hearts (%)	Area affected by hopper burn (%)	Yield (kg/ha)
1	1.7	3.0	80	1400
2	2.4	3.0	95	[illegible]
3	2.5	2.4	80	1904
4	3.6	3.1	55	[illegible]
5	2.2	2.2	90	1736
6	2.2	3.7	65	[illegible]
7	1.0	1.4	2	[illegible]
8	1.5	2.2	0	3920
9	2.6	2.6	35	2128
10	3.6	3.6	90	[illegible]
11	4.0	2.2	90	1736
12	4.8	3.2	85	1400
13	2.0	3.0	60	1904
14	4.0	3.8	90	1064
15	4.0	1.7	90	140[illegible]
16	5.7	5.2	100	[illegible]
CD	NS	NS		752

Control of gall fly

There was significance between treatments. The lowest incidence of gall fly occured in Tr.7 (1.0%) which was closely followed by Tr.8 (1.5%) Tr. 1 (1.7%) and treatmants 5 & 6 (2.2%).

Control of stemborer

The attack of early brood causing deadhearts alone was observed. However, the treatment differences are not significant. The lowest incidence was noticed in Tr.7 (1.4%) followed by Tr. 15 (1.7%).

Control of Brown planthopper

The efficiency of the chemicals in controlling brown planthopper attack was assessed on the basis of area affected by hopperburn as well as the yield. Assessment of the area revealed that area affected by hopperburn ranged from 0 to 100 percent. In Trs. 7 & 8 which received Furadan three times, the pest incidence was only 0 & 2% while in the other chemicals it ranged from 35 to 90%. It was found that among the chemicals tried Furadan alone was effieient in controlling brown planthooper attack

Grain yield

The grain yield data clearly have indicated the differences in the efficacy of insecticides on brown planthooper control. Treatments 7 and 8 in which Furadan was used recorded the highest yield. Grain yield data were significant and treatments 7 and 8 were on par and were superior to the others.

Variety Evaluation Trial

The object of this trial was to evaluate the degree of resistance of different pre-release cultures to the attack of different pests and yield potential both under protected condition as well as unprotected condition. The experiment was laid out in split plot design using protection and unprotection as the major treatments and the different cultures as minor treatments. The crop was protected using Birlane granules at 1.5 kg a.i/ha at 10, 30, 50 and 70 days after planting, and Phosvel EC at 0.5 kg a.i/ha against leaf eating pests.

The trial was conducted only during the first crop season. During this season the incidence of pests was very negligible. Except for mild attack of silvershoot and very light attack of leaf roller there was not much incidence of other pests. With regard to the incidence of silvershoot there was no significant difference. The incidence of deadhearts was practically Nil. The low incidence of pests reflected on the yield thereby showing not very much difference in yield between the protected and unprotected plots. The details of cultures used and the results are presented in Table E.5.

Table E.5. Varietal response to the incidence of stemborer and grain yield

Cultures/ variety	Silver Shoot (%)			Grain yield (kg/ha)		
	Protected	Unprotected	Difference	Protected	Unprotected	Difference
Culture 1285	3.4	4.2	0.8	4250	3750	500
Culture 12035	3.9	5.0	1.1	4150	3850	300
Culture 6473	3.6	6.8	3.2	4400	4250	150
Culture 1140	2.6	4.1	1.5	4550	4350	200
IET. 1996	3.2	4.4	1.2	4000	3800	200
Thriveni	3.4	4.2	0.8	4400	3800	600
Aswathy	3.4	5.5	2.1	4200	4100	100
Jaya	3.4	4.9	1.5	4700	4350	350

Epidemiology of insect pests of rice

The object of the experiment was to study the ecology of major insect pests of rice using information gathered from infestation encountered in periodic plantings. This trial was started from the year 1966-67. Fortnightly plantings were done in an area of 100 sq. meters using IR.8 seedlings starting from the normal season i.e. from the first fortnight of June. The plantings were continued till the first fortnight of January next year. Observations on the incidence of silvershoot, deadhearts and white earhead were taken regularly. In addition, information on the incidence of other pests were also collected.

Previous results showed that maximum infestation by gall-midge was registered on crops planted during June in association with high rainfall and low maximum temperature, the crop subsequently planted showing a sharp decline in pest incidence. In the case of stem borer incidence maximum borer infestation was recorded in plantings done during the period from the first fortnight of October to the first fortnight of January while the lowest pest incidence was recorded in plantings done during the period from the first fortnight of June to the first fortnight of October.

During the year, the maximum incidence of silvershoot was recorded in the plantings done during the second fortnight of June (Table E.6) followed by the planting done in the 1st fortnight of June. The highest incidence of dead hearts was recorded in the plantings done during the first fortnight of January followed by second fortnight of September and 1st fortnight of November. The highest white ear counts were recorded in the plantings done during the second fortnight of December followed by plantings done in the 2nd fortnight of July and 1st fortnight of October.

Table E.6. Epidemiology of rice pests

Tr. No.	Planting fortnight	Mean % incidence of Silver shoot	Dead heart	White ear heads	Mean yield (kg/ha)
1	June I fortnight	4.7	6.0	2.1	3400
2	Jun II fortnitht	10.8	5.2	0.2	3800
3	July I fortnight	1.2	2.9	3.0	5500
4	July II fortnight	3.3	0.2	7.5	3600
5	August I -do-	0.5	4.6	1.2	3000
6	August II -do-	2.0	1.5	0.4	420
7	September I -do-	0	1.1	3.4	5000
8	September II -do-	3.0	8.6	4.8	340
9	October I -do-	2.7	3.2	7.0	[illegible]
10	October II -do-	4.1	3.2	0.2	2800
11	November I -do-	2.6	8.0	0	260
12	November II -do-	0.2	2.8	4.1	1500
13	December I -do-	0.2	5.3	1.8	2000
14	December II -do-	0	4.3	17.1	1800
15	January I f-do-	0	11.6	0.1	2700

ENTOMOLOGY TRIALS CONDUCTED UNDER THE ALL INDIA COORDINATED RICE IMPROVEMENT PROJECT

Chemical Evaluation trial-1 (Granules)

The object of the trial was to evaluate the effectiveness of selected available chemicals for the control of each specific pest.

Nine chemicals in the form of granules were screened against the local practice of spraying Ekatox as and when pests appear, and an unsprayed control. A maximum protection treatment was also included in this trial. The treatments were applied 3 times (25-7-73, 21-8-73, 15-9-73) during the crop growth when insect population was noted high enough to evaluate insecticidal activity. For maximum protection treatment the seedlings were dipped in 0.2% Carbofuran solution for 12 to 14 hours before planting. Afterwards Cytrolane (G) at 1.0 kg a.i/ha was applied at 20,40 and 60 days after planting. The test variety was Jaya.

Data on stemborer and gallmidge along with total tillers were collected at 30 and 50 DAT by counting deadheart and silver-shoots, respectively, on 20 random hills from each plot. Just before harvest the number of white ears and panicle bearing tillers were also observed and recorded. Each plot was scored on a 0 to 10 scale for general appearance at 30 and 80 days after planting.

Table 3.8. Percentage of silver shoot, deadhearts, white ears and yield of grain as influenced by insecticides in the Chemical Evaluation Trial-1 (Granules)

Treatment No.	Insecticides	Dose in (kg ai/ha)	Silver Shoot 30 DAT	Silver Shoot 50 DAT	Dead heart 30 DAT	Dead heart 50 DAT	White ears (%)	Yield (kg/ha)
1	B.H.C.	1.5	1.6	11.4	0	0.3	0.3	[illegible]
2	Birlane	1.5	2.1	7.7	0	0.3	0.4	[illegible]
3	Cytrolane	0.5	0.3	4.4	0.3	0.6	1.5	4183
4	Diazinon	1.5	0.3	1.4	0	0	0.3	4505
5	Dintrex	1.5	1.4	7.5	0	0	0.3	4312
6	Ekalux	1.5	2.6	0.9	0	0	0.7	[illegible]
7	Dasanit	1.5	1.0	3.5	0	0	1.5	[illegible]
8	Sevidol	1.5	1.9	10.5	0	1.2	1.4	[illegible]
9	Thimet	1.5	1.1	1.6	0	0	2.7	[illegible]
10	Maximum protection		0.4	0	0	0.9	1.3	4167
11	Local practice		1.0	6.3	0	2.0	3.3	3378
12	Control		2.1	7.8	0	1.0	1.4	[illegible]

DAT = Days after transplanting

Gallmidge

In all the treatments gall midge incidence was more severe in 50 DAT than in 30 DAT. In 50 DAT the percentage of incidence varied from 0 (M.P.T) to 11.4 (B.H.C) and in 30 DAT it varied from 0.3 (Cytrolane and Diazinon) to 2.6 (Ekalux)

With regard to gall midge incidence there was significant difference between the treatments. The maximum protection treatment followed by Ekalux, Diazinon, [redacted] and Dasanit in order of merit were found to be superior (range . to 3.5%)

to other chemicals for the control of gall fly. Maximum incidence was observed in plots treated with B.H.C., Sevidol, Birlane and Diptrex ranging from 11.4 to 7.5%.

Stemborer

On 30 DAT the incidence of dead heart was Nil but on 50 DAT it varies from 0 to 2% only. Hence there was no significant difference between the treatments. On 50 DAT no incidence of deadheart was noticed in plots treated with Diazinon, Thimet, Ekalux, Basanit and Diptrex. A maximum of 2% incidence was estimated in plots treated with Ekatox. In the maximum protection treatment only 0.9% of incidence was noticed.

With regard to white ears the incidence varied from 0.3 to 3.3% only. Maximum incidence was noticed in plots treated with Ekatox (3.3%). Less incidence was noticed in plots treated with Diazinon, Diptrex, Birlane, B.H.C and Ekalux.

Leaf roller

For the control of leaf roller Ekalux, Sevidol, Basanit, Cytrolan proved to be the best. Leaf roller attack was practically nil in maximum protection plots and it was maximum in B.H.C., Diazinon and Thimet treated plots.

Grain yield

Highest yield was recorded by plots treated with Ekalux followed by Basanit, Diazinon and B.H.C. It ranged from 5??1 kg/ha to 4842 kg/ha.

General appearance 0 to 10 scale

On 30 days after planting under general appearance when 0 to 10 scale was used plots treated with Ekalux, Birlane, Basanit, Sevidol and Thimet scored maximum excellence. On 80 DAT when there was an attack of leaf roller plots treated with Ekalux, maximum protection plots, sevidol, Cytrolan were found excellent in their performance.

Chemical Evaluation Trial-II (Sprays)

In this trial chemicals in the form of E.C. along with maximum protection treatment, local practice (Ekatox) and untreated control were tried. Treatments were applied four times (25-7-73, 3-8-73, 24-8-73 and 15-9-73) during the crop growth. For maximum protection treatment the seedlings were dipped in 0.02% Carbofuran solution for 12 to 14 hours before planting. Afterwards cytrolane at 1 kg a.i/ha was applied at 20,40 and 60 DAT. The variety tried was Jaya.

Data on stemborer and gall midge along with total tillers were collected at 30 and 50 DAT by counting deadheart and silvershoot on 20 random hills from each plot. Just before harvest the number of white ears and panicle bearing tillers were also observed and recorded. Each plot was scored on a 0 to 10 scale for general appearance at 30 and 80 days after planting.

Gallmidge

In all the treatments gallmidge incidence was more severe in 50 DAT than in 30 DAT. In 50 DAT the percentage of incidence varied from 3.2 (maximum protection) to 8.9 (Nuvacron) and in 30 DAT it varied from 0 (Phosvel) to 2 (Ekalux). There was significant difference in the percentage of incidence between the treatments. Maximum protection treatment followed by Dursban, Folidol and Ekalux in order of merit were found to be superior (range 3.2 to 4.2%) to other chemicals for the control of gall-fly. Maximum incidence was observed in plots treated with Nuvacron, Bidrin, Phosvel, Dimecron and Thiodan, ranging from 8.9 to 6.3% (Table E.9).

Stemborer

On the 30 DAT the incidence of deadheart was Nil but on 50 DAT the percentage of incidence varied from 1.3 (Nuvacron) to 5.8 (Thiodan). Less incidence of deadheart was noticed in the order of merit in plots treated with Nuvacron, Folithion, Dimecron, Ekatox and maximum protection treatment. White ears were less in plots treated with Phosvel, Dursban, Sevin, Dimecron, Thiodan and Bidrin (range 0.4 to 0.7)

Leaf Roller

For the control of leaf roller it was observed that Phosvel, maximum protection treatment, Sevin, Folithion and Ekalux in the order of merit proved to be the best.

Grain yield

Highest yield was recorded by the plot treated with Folidol followed in order of merit by Ekatox, Phosvel and maximum protection treatment. It ranged from 5345 kg/ha to 4960 kg/ha. Folidol, Ekatox and Phosvel recorded a higher yield than maximum protection. From this it is seen that sprays are more effective than application of granules.

Table E.9. Incidence of silver shoot, stem borer and grain yield as influenced by insecticides in the Chemical Evaluation Trial-II (Sprays)

Tr. No.	Insecticide	Dose (kg ai/ha)	Silver Shoot %		Dead heart %		White ears	Grain yield (kg/ha)
			30 DAT	50 DAT	30 DAT	50 DAT		
1	Bidrin	0.5	1.1	7.3	0	4.0	0.7	4846
2	Dimecron	0.5	1.9	6.9	0	2.1	0.4	4688
3	Dursban	0.2	1.0	3.7	0	4.3	0.4	4711
4	Ekalux	0.5	2.0	4.2	0	4.0	1.9	4778
5	Folidol	0.5	1.3	3.9	0.3	5.7	1.1	5345
6	Folithion	0.5	1.3	5.6	0	1.9	1.1	4869
7	Lebaycid	0.5	1.6	5.3	0	3.7	4.0	4779
8	Nuvacron	0.5	0.7	8.9	0	1.3	1.4	4461
9	Sevin	0.5	1.5	4.3	0	3.5	0.4	4439
10	Thiodan	0.5	0.4	6.3	0	5.8	0.7	4869
11	Phosvel	0	0	6.5	4.0	0.8	0	5028
12	Maximum protection		0.8	5.2	0	2.6	1.1	4960
13	Localpractice (Ekatox)		1.4	4.8	0	2.4	1.4	5208
14	Control		1.1	5.1	0	4.5	1.4	[illegible]

General appearance 0 to 10 scale

On 50 days after planting when 0 to 10 scale was used for general appearance it was found that the stand of the crop in the plots treated with Phosvel, Sevin, Ekalux, maximum protection treatment and Dimecron was excellent. On 80 DAT when there was an attack of leaf roller and leaf folder, plots tr[illegible]ted with Phosvel, maximum protection treatment, Sevin, Folithion and Ekalux were found excellent in their performance.

New Insecticide Trial-I (Granules)

The object of this trial was to screen newer chemicals in the form of granules so as to identify potent but safer chemicals than parathion and Endrin which are already in large scale use.

Eight chemicals in the form of granules alongwith maximum protection treatment (as in the previous trials) and untreated control were tried in this experiment. The treatments were applied 3 times on 25-7-1973, 21-8-73 and 6-9-73 during the crop growth when insect population was noted high enough to evaluate insecticidal activity. The test variety was Jaya.

Data on the stemborer and gall midge along with total tillers were collected at 30 and 50 DAT by counting deadheart and silver shoots respectively on 20 random hills from each plot. Just before harvest the number of white ears and panicle bearing tillers were also observed and recorded. Each plot was scored on a 0 to 10 scale for general apperance at 30 and 80 days after planting (Table E.10)

Gall midge

Incidence was comparatively high in 50 DAT than in 30 DAT. The percentage of incidence varied from 1.5 in maximum protection treatment to 5.5 in Furadan. For the control of gall midge, the following treatments in the order of merit were found to be better: maximum protection, Padlin rd, Dursban and Miocin. Maximum incidence was observed in plots treated with Folithion, Lebaycid and Furadan (G).

Stem borer

On 30 and 50 DAT the incidence of deadheart was Nil in all the treatments. Only in plots treated with Folithion and Agour 1.1 and 0.3% dead heart was observed on 50 DAT. With regard to white ears the incidence varied from 0 to 1.3 in Miocin and Furadan. In plots treated with Lebaycid, Padlin rd, Galecron, Rogour and maximum protection treatment, no incidence was observed.

Leaf roller

For the control of leaf roller maximum protection treatment, Galecron, Folithion, Dursban and Miocin in the order of merit proved to be the best.

Grain yield

Highest yield was recorded by plot treated with Galecron followed by maximum protection treatment, Mipcin, Furadan and Folithion. It ranged from 5474 kg/ha to 4508 kg/ha.

Table 3.10. Pest incidence and grain yield as influenced by different treatments in the new insecticide trial-I

Tr. No.	Insecticides	Dose (kg. ai/ha)	Silver Shoot (%) 30 DAT	Silver Shoot (%) 50 DAT	Dead heart (%) 30 DAT	Dead heart (%) 50 DAT	White ears (%)	Yield (kg/ha)
1	Dursban	0.5	0.3	2.3	0	1.1	0.7	4412
2	Folithion	.5	1.0	5.6	0	0	0.7	4508
3	Lebaycid	1.5	1.7	4.4	0	0	0	4154
4	Mipcin	1.5	1.2	2.3	0	0	1.3	4734
5	Pallisard	1.5	1.0	2.2	0	0	0	4347
6	Galecron	1.5	1.3	3.6	0	0	0	5474
7	Furadan	0.2	2.2	3.5	0.5	0	1.3	4573
8	Rogour	0.5	0.9	3.5	0	1.3	0	4411
9	Maximum protection		0	3.5	0	0	0	4863
10	Control		0	4.2	0	0.3	2.9	3123

New Insecticide Trial-II (Sprays)

The object of this trial was to screen newer chemicals in the form of sprays so as to identify potent but safer chemicals than Parathion and Endrin which are already in large scale use.

Eight chemicals in the form of sprays along with maximum protection treatment and untreated control were tried in this experiment. The treatments were applied four times on 18-7-1973, 25-7-73, 15-8-73 and 8-9-73. The variety tried was Jaya.

Data on stem borer and gall midge along with total tillers were collected at 30 and 50 DAT by counting dead hearts and silver shoots, respectively, on 20 random hills from each plot. Just before harvest the number of white ears and panicles bearing tillers were also observed and recorded.

The results are presented in Table 3.11.

Gall midge

Incidence on 30 DAT varied from 2.0 (Zolone) to 5.7 (Orthene) and on 50 DAT it varied from 2.3 (Tameron) to 8.2 (Orthene). In control plots there was an incidence of 4.7% on 30 DAT and 8.3% on 50 DAT. For the control of gall midge followin chemicals in order of merit are found to be the effective. Tameron, maximum protection treatment, Zolone, Furadan and Mipcin. Maximum incidence was observed in plots treated with Macbal, Orthene, Knockbal.

Stem borer

On 30 DAT the incidence of dead heart was very low, it varied from 0 to 0.5. But on 50 DAT it varied from 0.3 (Orthene) to 3.3 (MPT) Very low incidence of dead heart was noticed in plots treated with Orthene, Macbal, Tameron and Knockbal. With regard to white ears the incidence varied from 0 to 0.8 only. In all the plots the counts of white ears were negligible.

Leaf roller

The maximum protection treatment followed by Mipcin, Fundal, Tameron and Zolone in the order of merit proved to be the best in the control of leaf roller.

Grain yield

Highest yield was recorded by the plot treated with Fundal which was followed by plots treated with maximum protection treatment, Zolone, Mipcin, Macbal, Tameron and Orthene. It ranged from 5894 kg/ha to 5167 kg/ha.

Table 3. 11. Pest incidence as affected by different treatments in the New Insecticide Trial-II (Sprays)

Tr. No.	Insecticides	Dose (kg.ai/ha)	Silver Shoot(%) 30 DAT	Silver Shoot(%) 50 DAT	Dead heart (%) 30 DAT	Dead heart (%) 50 DAT	White ears	Grain yield (kg/ha)
1	Mipcin	.5	3.5	4.1	0	0.4	0.4	5245
2	Tameron	.5	3.7	2.3	.2	1.0	0	5167
3	Vamidothion	.5	2.6	5.7	0	2.1	0.8	4835
4	Zolone	.5	2.0	4.8	0	1.0	0	5262
5	Fundal	.5	3.5	4.1	.5	1.8	0	5894
6	Orthene	.5	5.7	8.2	0	0.3	0	5167
7	Macbal	.25	5.1	5.3	0	0.6	0.4	5230
8	Knockbal	.5	4.1	5.1	0	1.6	0	4835
9	Maximum protection		2.6	3.5	.2	3.3	0.4	5688
10	Control		4.7	8.3	.3	2.4	0	4582

Seedling Dip Experiment

The object of this trial was to evaluate the effectiveness of seedling dip treatment and some late nursery treatments for controlling insect pests during the plant establishment stage . Jaya was used as the test variety during both the seasons.

There were 13 insecticidal treatments with different insecticides consisting of 4 treatments in the nursery and 9 treatments as seedling dip with two untreat d controls. Birlane (treatment No. 7) was used instead of Agronile.

Data on silver shoots, dead heart and leaf roller along with total tillers were taken 30 days after planting from 10 plants each. Besides, each plot was scored on a 0 to 10 scale for general appearance and good vigour at 20, 40 and 60 days after planting.

Nursery treatments were applied 3 to 4 days before uprooting and s edling treatments were applied for about 14 hours before planting.

Seedling dip treatment proved bett r than nursery treatment. Seedlings dipped in Thiodan and Folidol were affected by the chemical giving a scorched appearance at the time of planting but recover d later. High p rcentage of seedling mortality was observed in Birl ne (S.D.) and Dimecron (S.D)

Dursban (S.D.) and Diazinon (S.D.) treated seedlings established well and the attack of whorl-maggot, gall midge and stem borer were completely controlled up to 30 days after planting. Besides seedlings dipped in Furadan and Cytroline were also excellent, in their performance. None of the nursery treatments were found effective up to 30 days after planting. Birlane (S.D.) was quite ineffective and the mortality of seedlings was very high.

Screening of gall midge resistant varieties

The comparative yield performance and relative resistance to gall midge of certain gall midge resistant selections were investigated in this experiment.

The experiment was laid out in a split plot design with two replications and 40 varieties. The main plots were protected and non-protected and the sub-plots were 40 varieties.

In the protected plots Thimet at 12.5 kg/hect. was applied two times after planting i.e. 7 to 10 days after planting and at 15 days after the 1st application.

40 cultures derived from the following crosses were tried.

1. IR.8 x Ptb. 21
2. IR.8 x Ptb. 18
3. IR.8 x W 1263
4. IR.8 x W 1257
5. IR.8 x W 1251
6. IR.8 x Siam-29
7. CR.56-17 x IR.8
8. CR.56-13 x IR.8
9. CR.55-36 x IR.8

In general the cultures showing complete resistance to gall midge were very poor yielders. Considering the high yield potentiality, the cultures having less incidence of gall midge were selected. Altogether 27 cultures showing high yield performance combining with less gall midge incidence were finally selected for further trials. They included the following cross combinations.

Sl.No.	Cross	Culture No.	IET. No.
1	IR.8 x Ptb.21	1201	1788
		1202	2789
		1204	2791
2	CR-56-7 x IR.8	1205	2795
		1207	2797
		1208	2798
3	CR-56-36 x IR.8	1210	2802
4	IR. 8 x Siam-29	1212	2885
		1213	2886
		1214	2911
		1228	1901
		1229	2902
		1230	2903
		1237	3231
5	IR.8 x W.1263	1215	2886
		1227	2900
		1235	2946
6	IR.8 x W.1257	1217	2890
		1218	2891

7	IR.8 x W. 1251	1219	2892
		1220	2893
		1221	2894
		1222	2895
		1223	1895
		1224	1897
8	CR-55-13 x IR.8	1231	2904
9	CR-55-12 x IR.8	1238	3232

Out of these cultures following cultures viz., 1219, 1220, 1221, 1222, 1223 derived from the cross IR.8 x W. 1251. Culture 1210 from the cross CR. 55-36 x IR.8, Culture 1207 from the cross CR.56-17 x IR.8 and culture 1217 from the cross IR.8 x W 1257 yielded the maximum.

<u>Leaf folder screening</u>

One hundred and forty varieties (entries) were screened in this trial for leaf folder resistance. The check varieties were Jaya and W. 1263.

In late season, cultures were evaluated for leaf folder incidence on five most damaged plants within each row when maximum damage was observed.

Out of 140 entries following 52 cultures having no incidence of leaf roller were selected for further trials.

<u>Entry numbers</u>:

5	30	59	70	120	133
7	31	60	78	125	134
10	32	61	79	126	135
14	33	62	101	127	137
15	34	63	105	128	138
18	39	64	106	129	139
4	40	66	107	130	140
26	45	67	110	131	
28	57	68	114	132	

Trials initiated in the second crop season (mundakan)

Maximum protection trial

Object of this trial was to estimate the magnitude of yield loss resulting from the insect pests and also to ascertain the reaction of varieties to protection afforded by the insecticides. The varieties tried were:-

1. RP.6-17	5. RP.9-4
2. RP.4-14	6. IET. 2656
3. C. 13801	7. CR. 12-178
4. IET 2511	8. Jaya

Maximum protection was given with the starting of nursery spray of 0.4 kg/ai/ha of Parathion, seedlings dip in 0.02% Carbofuran suspension for 12 to 14 hours and finally with the application of Cytrolane granules @ 1 kg a.i/ha at 20,40 and 60 DAT. The table E. 12 gives the results.

In all the varieties under protected plots the incidence of brown hopper was very severe than in the unprotected plots. Therefore, the yield was considerably reduced in the protected plots than in the non-protected plots. However RP.6-17, RP.4-14 and CR 12-178 gave increased yields in the protected plots than in the unprotected plots. In all the other 5 varieties a higher yield was recorded in the unprotected plots. The yield difference ranged from 262 kg/ha (IET 2656) to 625 kg/ha (Jaya). Jaya showed maximum yield reduction in the protected plots. Cytrolane was best in the control of hopper.

Gall midge

Damage was relatively low in the protected than in the unprotected area. It ranged from 0.3 to 0.5% in the protected and from 1.3 to 5.7% in the unprotected. Maximum attack of gall midge was recorded in IET 2511, Jaya and CR 12-178.

Stem borer

Dead heart incidence was noticed high in the non-protected plots than in the protected plots. It ranged from 4.1 to 9.4% in the non-protected plots and 0.3 to 1.2% in protected plots. Maximum dead heart incidence was recorded in IET 2656, CR 12-178, RP6-17, C. 13801 and IET. 2511.

White ears at the time of harvest were not observed due to severe hopper burn.

Table E. 12. Data on dead hearts, silver shoot and grain yield of Jaya rice

	Variety	Dead heart (%)		Silver Shoot (%)		Yield (kg/ha)	
		50 DAT protected	Non-protected	50 DAT protected	Non-protected	protected	Non protected
1	RP.6-17	1.0	6.0	0	2.1	1737	1113
2	RP.4-14	0.2	4.8	0	3.2	1800	1181
3	Cl.3801	0.7	7.1	0	1.3	1300	1644
4	IET.2511	0.6	6.5	0.3	5.0	338	788
5	RP. 9-4	0.3	4.8	0	1.9	594	1133
6	Jaya	0.9	4.1	0.5	5.5	781	1406
7	IET.2656	1.2	9.4	0.6	1.0	238	500
8	CR.12-178	1.2	6.8	0.3	5.1	1675	1269

Chemical Evaluation Trial (Granules)

In this trial Cytrolane, Ekalux, Furadan and Birlane at three different doses were tried along with a maximum protection treatment and local control.

There was very severe incidence of brown planthopper in all the treatments from 35 DAT onwards except in plots treated with Furadan at the rates of 0.75, 0.5 and 0.25 a.i/ha. Hence the yield was considerably reduced in all the other treatments. It ranged from 1000 kg/ha to 4100 kg/ha. Plots treated with Furadan at 0.75 kg ai/ha gave maximum yield followed by Furadan at 0.5 and 0.25 kg ai/ha. Lowest yield was recorded in plots treated with Ekalux and Birlane in all the doses. Maximum protection treated plots also recorded low yield (Table E.13).

Gall midge

Silver shoot counts ranged from 1% (Maximum protection treatment) to 4.3 (Furadan 0.25%). Maximum incidence was noticed in Furadan followed by Ekatox, Birlane and Cytrolane applied at 0.25 kg a.i/ha. Very low incidence was noticed in maximum protection treatment followed by Furadan (0.75), Ekalux (0.5) and 0.75 and Cytrolane (.75).

Dead heart

The local practice of spraying Ekatox proved to be highly effective and was superior to Cytrolane, Ekalux and Birlane. Furadan at 0.5 kg a.i/ha was, however as effective as Ekatox

Table E.13 Dead heart, silver shoot, white ears and grain yield as influenced by different chemicals

	Treatment	Dose (kg ai/ha)	50 DAT Dead heart (%)	50 DAT Silver shoot (%)	White ears (%)	Mean grain yield (kg/ha)
1	Cytrolane	0.75	0.6	1.6	6.1	2057
2	,,	0.50	1.6	2.8	2.6	2130
3	,,	0.25	1.8	3.0	6.1	1010
4	Ekalux	0.75	1.5	1.5	9.3	1767
5	,,	0.50	0.9	1.3	2.8	1657
6	,,	0.25	1.1	2.5	6.7	1099
7	Furadan	0.75	1.1	1.4	0.9	4103
8	,,	0.50	0.4	2.7	1.7	3251
9	,,	0.25	0.8	4.8	1.6	303[illegible]
10	Birlane	0.75	0.7	2.6	4.3	1925
11	,,	0.50	1.5	2.4	5.8	1919
12	,,	0.25	1.6	4.1	3.6	1767
13	Maximum protection treatment		1.3	1.0	5.4	1610
14	Local		0.4	4.4	5.6	2335
15	Control		1.0	4.0	2.4	2020

Chemical Evaluation Trial (Sprays)

During the season, Dursban, Ekalux, Folithion, Phosvel, Mipcin, Birlane, Dimecron, and Thiodan in two different doses viz., 0.5 and 0.25 kg a.i/ha were tried along with maximum protection treatment, Ekatox (local) and control.

The results are presented in Table E.14.

There was very severe incidence of brown planthopper in all the treatments from 35 DAT onwards except in plots treated with Ekalux (0.5), Mipcin (0.5), Birlane (0.5 and 0.25) and Dimecron (0.5 and 0.25 ai/ha) where the incidence was very low. The yield recorded was very low in all the pest affected plots. It ranged from 600 kg/hect (Ekatox) to 2762 kg/ha (Mipcin 0.5 kg ai/ha) Mipcin at 0.5 kg ai/ha gave the maximum yield.

Gall midge

Silver shoot counts ranged from 4.5% (maximum protection treatment) to 12% (Dursban 0.25). Less incidence was also noticed in the maximum protection treatment followed by Phosvel (0.5), Folithion (0.5), Ekalux (0.5) and Mipcin (0.25 kg ai/ha)

Dead heart and white ears

Dead heart counts ranged from 2.4% (Ekalux 0.25) to 7.4% (Ekatox). Low incidence was noticed in Ekalux at 0.5 and 0.25 kg a.i/ha, Phosvel at 0.5 kg a.i/ha, Dimecron 0.5 kg a.i/ha, maximum protection treatment and Mipcin at 0.5 kg a.i/ha. At the time of harvest white ear counts ranged from 0.3% (Phosvel 0.5) to 7.6% (Ekatox). Low incidence was noticed in Phosvel (0.5), Dimecron (0.5) and Mipcin (0.25).

Table 5.14. Dead hearts, silver shoots, white ears and grain yield as influenced by different chemicals

Treatment	Dose (kg ai/ha)	50 DAT Dead heart (%)	50 DAT Silver shoot (%)	White ears (%)	Mean grain yield (kg/ha)
1. Dursban	0.50	4.9	10.1	1.0	1925
2. ,,	0.25	4.0	12.0	1.7	1436
3. Ekalux	0.50	2.7	8.7	1.0	1736
4. ,,	0.25	2.4	11.7	3.6	1246
5. Folithion	0.50	5.4	8.7	5.5	1736
6. ,,	0.25	4.1	9.8	1.5	1057
7. Phosvel	0.50	2.7	8.9	0.3	2209
8. ,,	0.25	4.3	8.5	2.6	1378
9. Mipcin	0.50	3.3	11.2	1.3	2762
10. ,,	0.25	7.0	8.7	0.5	2525
11. Birlane	0.50	4.1	9.2	0.7	247[illegible]
12. ,,	0.25	6.3	11.1	1.1	2004
13. Dimecron	0.50	2.8	11.6	0.3	2146
14 ,,	0.25	6.0	10.3	4.7	1693
15. Thiodan	0.50	3.5	9.6	2.0	2225
16. ,,	0.25	6.3	10.2	1.5	2210
17. Maximum protection treatment		3.5	14.5	3.4	1134
18. Control		7.4	9.3	5.7	600
19. Local		4.6	10.2	7.6	1231
20. Filler		6.3	11.5	1.1	1136

New Insecticide Trial-1 (Granules)

Eleven chemicals in the form of granules at 1 kg a.i/ha along with maximum protection treatment and untreated control were tried in this experiment.

There was very severe incidence of brown planthopper in all the treatments from 40 DAT onwards except in plots treated with Mipcin, Carlin and Thimet where the incidence was very low.

The yield recorded was very low, in all the plots which ranged from 430 kg/ha (maximum protection treatment) to 4212 kg/ha (Mipcin). Plots treated with Mipcin gave the maximum yield followed by Galecron, Thimet and Carlin ranging from 4212 kg/ha to 2740 kg/ha. The maximum protection treatment recorded the lowest yield (Table E.15)

Gall midge

Silver shoot counts ranged from 0.6% (Dasanit) to 9.8% (Folithion). Low incidence of gallmidge was recorded in plots treated with Dasnit, Thimet, and maximum protection treatment and high incidence in Folithion, Lebaycid, Carlin, Azodrin and Rogour.

Dead heart and White ears

The incidence of dead heart was low in all the treatments which ranged from 0.4% (Thimet) to 3.8% (Azodrin). Very low incidence was noticed in Thimet followed by Agronule, Carlin, Dasnit and Mipcin ranging from 0.4% to 1%. The percentage of white ears at the time of harvest ranged from 0.5 (Galecron) to 9.4 (Dasnit). Low incidence in the order of merit were noted in plots treated with Carlin, Birlane, maximum protection treatment and Galecron.

Table E.15. Dead hearts, silver shoot, white ears and grain yield as influenced by different granular chemicals in the new insecticide trial-1

	Treatment	Dose (kg ai/ha)	50 DAT		White ears (%)	Mean grain yield (kg/ha)
			Dead heart (%)	Silver shoot (%)		
1.	Agronule	1	0.6	7.1	5.3	770
2.	Folithion	1	2.3	9.8	3.6	928
3.	Lebaycid	1	2.7	9.2	6.[illegible]	1042
4.	Mipcin	1	1.0	6.7	1.7	4212
5.	Carlin	1	0.6	8.0	0.5	2740
6.	Azodrin	1	3.8	9.7	2.5	1721
7.	Galecron	1	1.5	8.6	1.1	3465
8.	Birlane	1	1.0	5.8	1.0	3242
9.	Thimet	1	0.4	1.8	1.6	2967
10.	Dasnit	1	0.9	0.6	0.4	770
11.	Rogour	1	2.4	9.2	4.0	1426
12.	Maximum protection treatment		1.7	2.8	1.1	430
13.	Control		0.7	7.3	10.3	996
14.	Filler		2.1	5.9	3.7	1178

New Insecticide Trial-II (Sprays)

Twelve insecticides in the form of sprays at 0.5 kg ai/ha along with maximum protection treatment and untreated control were tried in this experiment.

The results are presented in Table E.16.

There was very severe incidence of brown planthopper in all the treatments from 35 DAT onwards except in plots treated with Bidrin (W.S.C.) Knockbal, Orthene, Fundal, Zolone, and Tamaron where the incidence was very low. The yield recorded was very low in all the plots. It ranged from 1826 kg/ha (Elsan) to 4235 kg/ha (Fundal). Fundal at 0.5 kg ai/ha gave the maximum yield of 4235 kg/ha followed by Orthene, Knockbal, Tameron and Bidrin (W.S.C) in the order of merit.

Gall midge

Silver shoot counts ranged from 0.15% (maximum protection treatment) to 8.4% (Ambithion). Less incidence was noticed in maximum protection treatment followed by Zolone, Birlane(S.G) and Lebaycid.

Dead heart and white ears

Dead heart counts ranged from 0 to 1.7%. No incidence was noticed in Ambithion and very less incidence was noticed in plots treated with maximum protection treatment, Tameron Knockbal and Vamidothion. At the time of harvest white ear counts ranged from 0.2% (Orthene) to 3.4% (Birlane). Very less incidence was noticed in plots treated with Orthene, Zolone, Bidrin (W.S.C.)Knockbal, Tameron and Fundal.

Table E.16. Dead hearts, silver shoot, white ears and grain yield as influenced by chemicals in the new insecticidal trial-II (Sprays)

	Treatments	Dose (kg ai/ha)	50 DAT Dead heart (%)	50 DAT Silver shoot (%)	White ears (%)	Grain yield (kg/ha)
1.	Tameron	0.5	0.2	7.7	0.95	3261
2.	Vamidiothion	0.5	0.3	8.2	1.6	2355
3.	Zolone	0.5	0.5	6.4	0.3	2672
4.	Fundal	0.5	0	7.8	0.9	4235
5.	Orthene	0.5	0.9	7.2	0.2	4137
6.	Knockbal	0.5	0.2	6.8	0.8	3261
7.	Macbal	0.5	1.2	7.6	2.1	2229
8.	Bidrin	0.5	0	7.8	0.3	3216
9.	Birlane (Spreading oil)	0.5	1.7	6.3	3.4	1789
10.	Lebaycid	0.5	0.7	6.6	1.7	2151
11.	Ambithion	0.5	0	8.4	1.8	1698
12.	Elsan	0.5	0.5	6.7	2.4	1426
13.	Maximum protection		0.2	.15	1.3	1857
14.	Control		0.7	7.0	4.3	127[illegible]

Gall Midge Screening Trial

Out of 163 entries sent for the trial only 137 entries were tried. The remaining cultures did not come in time. The cultures were sown on 1-10-73 and planted on 3-11-73. Each culture was planted in two rows of 17 hills. Susceptible and resistant checks were planted on either side of every 5 test cultures. Following 49 cultures were finally selected having nil or very low incidence of gallmidge.

Cul. 6	Cul. 33	Cul. 55	Cul. 79	Cul. 103
11	36	56	80	109
12	38	57	88	110
20	41	58	91	11[illegible]
21	45	59	95	115
22	48	61	98	11[illegible]
26	49	64	100	14[illegible]
27	50	69	101	147
32	54	78	102	1[illegible]4
			155	159
			157	162

PLANT PATHOLOGY

The Plant Pathology Division concentrated its attention on developing rice varieties resistant to blast and sheath blight. Several blast resistant lines have been isolated from the cross IR.8 x Zeneth, IR.8 x Tetep and IR.8 x Tadukan. Screening of chemicals for the control of blast, sheath blight and *Helminthosporiose* was also continued.

Screening for blast resistance

Breeding work was initiated in 1972 to evolve varieties resistant to blast. Tetep, Tadukan and Zeneth were used as donors for blast resistante. The progenies are now in the F_7 generation. Forty six promising lines from the different crosses were isolated during the year which showed high blast resistance even under favourable conditions for disease development (Table P.1). Most of these lines are either tall or semitall. These lines will be tested again during the next viripou and mundakan seasons.

Table P.I. Progenies showing blast resistance

Cross	No.of lines selected
IR. 8 x Zeneth	11
IR. 8 x Tetep	10
IR. 8 x Tadukan	11
CR. 36-148 x Tetep	10

Screening varieties for multiple resistance

Twenty varieties selected from various screening trials were tested for their yield potential in a comparative yield trial. Thriveni, Jyothi and Jaya were the check varieties. Thirteen varieties showed multiple resistance to diseases (Table P2.). However, their yield potential could not be rated with those of the check varieties because the crop was effected by drought. The trial will be repeated during the next year.

Table P.2. Varieties showing multiple resistance

Variety/culture	Cross
15 573-3	IR.5 x CP. 12
15 591-4	,,
15 612-1	,,
15 616-1	,,
8140	T(N) 1 x Mtu. 15
8241	Ch 97 x IR 9-60
IET. 2691	
IET. 2694	
IET. 3210	
IET. 3542	
IET. 2713	
IET. 2931	
IET. 3006	

Chemicals for blast control

The comparative efficacy of different fungicides on the control of rice blast (*Pyricularia oryzae*) was investigated in a replicated trial laid out in randomized block design. The treatments comprised of Hinosan (420 ml/ha), Dithane Z 78(1250 g/ha), Aureofungin (7.5 g/ha), Miltox (1250 g/ha) and Kasumin (1500 g/ha) and an unprotected control. A highly susceptible rice strain Co. 13, was used as the test variety.

All the chemicals were equally effective on the control of blast. Miltox, however, tended to reduce grain yield, probably due to its toxic effect on plant tissues. The highest yield was recorded by aureofungin. Kasumin ranked second. The percentage increase in grain yield recorded by these chemicals over the unprotected control was 68 and 50, respectively.

Fungicidal control of sheath blight

Sheath blight is one of the most serious diseases of rice in Kerala. The high yielding rice varieties are particularly susceptible to this disease caused by *Corticium sasakii*. The loss in yield on account of this disease is considerable. Earlier trials have indicated that sheath blight could be controlled by chemicals like Hinosan and Dithane. The efficiency of new chemicals on the control of this disease was evaluated in this trial. The chemicals included Hinosan, Dithane Z 78, Aureofungin, Miltox and Nebazozin. These chemicals were tried aginst an unprotected control in a replicated trial. The test variety was Annapoorna, an early duration sheath blight susceptible strain.

The intensity of disease incidence was mild during the crop season and therefore, no significant yield variation was observed between treatments. Hinosan recorded the maximum grain yield followed by Nebazosin. The increase in yield registered by Hinosan over the unprotected control was only 2 percent. Miltox, however, produced an yield which was 7% less than that of the unprotected control. This was probably due to its toxic effect on the plant. Toxicity of this chemical appears to be due to its high content of copper. In the previous trials also, Miltox has been observed to be toxic to rice and Annapoorna is highly susceptible to copper toxicity. It is suggested that neither Miltox nor Fytolan (or any other fungicide containing copper) be sprayed on a susceptible variety like Annapoorna.

Control of Helminthosporiose

Helminthosporiose or brown spot disease (blight) occurs all over the state in all the 3 rice growing seasons. This disease is often overlooked, as the damage caused by it is not very serious. But under conditions quite conducive for the growth of the pathogen, the disease can assume serious proportions causing considerable yield reduction. No variety is quite resistant to this disease and therefore, protection of the crop with chemicals is the easy method of controlling disease incidence.

The present investigation was undertaken to screen chemicals for the control of helminthosporiose.

Five chemicals- Hinosan, Dithane Z 78, Aureofungin, Miltox and Dithane M 45- were tested against an unprotected control in a randomised block design with 4 replications. The test variety was Annapoorna.

The data on disease score and grain yield revealed no statistical significance between treatments. The intensity of incidence of the disease was mild and therefore, the relative efficacy of the chemicals could not be rated from the data gathered.

PATHOLOGY EXPERIMENTS CONDUCTED UNDER THE ALL INDIA COORDINATED RICE IMPROVEMENT PROJECT

Uniform Blast Nursery

The object of the trial was to rate entries especially those in the ' National Breeding Nursery ' for their reaction to leaf blast. The intensity of disease incidence was scored based on the 1-7 grade score chart.

The disease pressure was low (12.8%) in general. The following designation numbers were found to be resistant or moderately resistant to leaf blast.

i. R.P. 5-14	ix. RP 360-98-13-2-3
ii. 1139	x. RP 270-1
iii. 1180	xi. RP 20-12
iv. RP 319-3-1-8	xii. RP 270-2-1-1-1-1
v. MTU 885	xiii. 30158
vi. OR 10-193-10-20	xiv. PAU 103-61-1-4
vii. 7265	xv. 13-6-25M
viii. 27092	xvi. TTB-2-8-6

xvii. 1138
xviii. 1167
xix. 1285
xx. MTU 824
xxi. OR 22-10
xxii. 6932
xxiii. 24450
xxiv. RP 260-98-12-2-2
xxv. RP 319-3-1-5
xxvi. RP 5-62
xxvii. CR 129-105
xxviii. 28687
xxix. 1468-5
xxx. PAU 128-217
xxxi. TTB 2-3-11-4
xxxii. 1468-5

International Uniform Blast Nursery

The aim of this trial was to test the varieties from the world germplasm found resistant at the International Rice Research Institute, for their reaction to blast under upland nursery conditions.

The disease pressure in the nursery was [illegible] high with a location severity index of 3.37. Thirty five varieties were found to be blast tolerant. Te-tep, Taduokan, Norin-[illegible], Rai Tulasi and Carle n, and Engkatek from Malaya, Doe phung from Vietnam and DM9 from Bangladesh were resistant

Evaluation of selections for neck and mature plant blast reaction

The reaction of different varieties (entries) to leaf blast at the seedling stage and neck blast at the flowering and grain ripening stages was studied under rainfed upland conditions. The relationship between leaf blast and neck blast observed in this trial was not in full agreement with the accepted theory that these two are positively correlated.

Helminthosporium Screening trial

Varietal resistance to helminthosporiose at seedling and adult plant stages was investigated in this trial. The infection was moderate with only 45.1 percent of the entries getting infection.

Of the 235 entries tested, 7.2% belonged to the resistant group (Score 1-2), 47.7% in the moderately resistant group (Score 3-4) and 45.1% in the susceptible group (Score 5-9).

Evaluation of selections for resistance to sheath blight

The object of this experiment was to assess the resistance of entries to sheath blight under field conditions and to compare the ' sheath blight ' and the 'banded leaf blight' phase of the disease.

The procedure for testing consisted of transplanting two rows of sixteen seedlings at a distance of 25 cm, between plants in a row. 'Karuna' was the susceptible check used after every twenty five entries. Infected stem pieces were inserted into the outer leaf sheaths of the first eight plants in the row for inoculating the test entries twenty five days after planting.

Of the 350 entries tested, nine had a disease index of ' I ' and sixty six had a disease index of ' 2'. Thirteen of these which were found promising at two other locations also are proposed to be tested again for confirmation. The following are the resistant entries.

i. JBS 15-4	viii. CR. 129-29
ii. MTU 5630	ix. AJAY 246 (tall)
iii. EC 94662	x. CR 10-4181-1
iv. RP 260-799-1	xi. OR 8-564
v. IR 930-31-1-1B	xii. R. 2122 (tall)
vi. RP 260-597-1	xiii. RP 4-2
vii. Manoharsali (tall)	

The banded blight phase was not observed during this season possibly due to the lack of continuous period with high relative humidity.

Coordinated blast control trial

The relative efficacy of new chemicals on the control of blast was studied in a replicated trial, laid out in randomised block design. The variety tried was Pusa 2-21. Kasumin, Hinosan, Benlate, Phosvel, Bavistin, IARI-1 and Blitox were the fungicides under test.

The incidence of blast during the season was very low. At the boot stage of the crop there was a moderate incidence of brown planthopper which was, however, kept under check by timely plant protection with Furadan 3 g.

Neck infection counts, being the average of the infected panicles to total number of panicles of 35 hills taken at random, were made. The data are furnished in Table P.3.

The data on statistical analysis were found to be significant at 1% level. The neck infection counts were maximum in the untreated control and were quite low in the plots treated with Phosvel, Benlate, Hinosan, Bavistin and Kasumin.

The plot yield data are tabulated in the same Table. The yield differences between treatments were statistically significant.

The yield was highest in the plots treated with Phosvel followed by Benlate, Hinosan and Bavistin. There was no significant difference between these four treatments. All the chemical treatments were superior to the control. The lowest yield was obtained from the untreated control.

Table P.3. Percentage of neck infection and grain yield as affected by chemicals in the blast control trial

	Treatment	Percentage of neck infection	Grain yield (kg/plot)
1	Kasumin	2.85	1.53
2	Hinosan	2.43	1.61
3	Benlate	2.10	1.80
4	Phosvel	1.38	1.83
5	Bavistin	2.70	1.36
6	IARI-1	5.43	1.58
7	Blitox	5.50	1.29
8	Unprotected control	7.95	0.76
	CD (0.05)	1.33	0.25

PULSES IMPROVEMENT

Trials in manuring cowpea, soyabean and black gram indicated that rhizobium inoculation of seeds improved the response of these crops to applied phosphorus.

Foliar application of superphosphate on cowpea

The response of cowpea to phosphate manuring as influenced by the mode of application was investigated in this experiment. Three levels of P were tried along with 2 methods of application i.e. soil and foliar (Table L.1). The test variety was Calicut-51, dibbled at a spacing of 20 cm x 15 cm. A common dose of N and K_2O was given as basal dressing at 20 and 10 kg, respectively, per hectare. The concentration of superphosphate solution was 1.5% for foliar feeding. Number of sprays varied between 1 and 6, depending on the rate of P_2O_5 applied as foliar spray.

The results revealed no significant differences between the levels of P and the methods of application. However, the maximum yield was recorded by the treatment receiving 90 kg P_2O_5 /ha. half as basal and the other half as 3 foliar sprays. Even at the 60 kg level, basal plus foliar application was found to better than soil or foliar application alone.

Table L.I. Yield of cowpea as influenced by different treatments

	Treatment (level of P_2O_5 kg/ha)	Mode of application	No. of sprayings	Legume yield (kg/ha)
1	No	--	--	407
2	30	Soil	--	559
3	30	$\frac{1}{2}$ soil + $\frac{1}{2}$ foliar	1	443
4	30	foliar	2	468
5	60	soil	--	480
6	60	$\frac{1}{2}$ soil + $\frac{1}{2}$ foliar	2	573
7	60	foliar	4	528
8	90	soil	--	503
9	90	$\frac{1}{2}$ soil + $\frac{1}{2}$ foliar	3	643
10	90	foliar	6	533
	F (0.05)			NS

Nitrogen and phosphate manuring of cowpea

In this experiment, effect of N, P and rhizobium on the yield of cowpea was investigated. The variety tried was Calacut-51. The treatments comprised of all possible combinations of 5 levels of nitrogen including rhizobium inoculation i.e. 0, 15, 30, 45 and rhizobium and 4 levels of P i.e. 0, 30, 60 and 90 kg P_2O_5/ha. Potash was applied to all the 20 treatments at 10 kg/ha. In the rhizobium treated plots, no fertilizer nitrogen was applied.

The effects due to fertilizer nitrogen alone was found to be statistically significant. Neither P nor its interaction with N exerted marked influence on grain yield. Nitrogen at the 30 kg/ha level produced the highest yield and it was significantly superior to the 15 and 45 kg/ha N levels. (Table L.2.) Bacterial fertilization proved only slightly superior to the the no manure control, the increase in yield being 38 kg/ha. This shows that rhizobium inoculation is ineffective in the lateritic soil. It is possible that the acid condition in the upland soils are not conduceive for the activity of the inoculated rhizobia. Another information gathered from this study is that response to applied phosphorus is increased in conjunction with rhizobium inoculation.

Table L.2. Yield of cowpea as affected by rhizobium, fertilizer nitrogen, and phosphorus

Nitrogen kg/ha					Phosphorus kg/ha			
0	15	30	45	rhizobium	0	30	60	90
562	747	823	733	600	622	685	788	680
C.D (0.05)			67				NS	

<u>Manuring of soyabean</u>

Soyabean is a newly introduced crop in Kerala. Since no research data on the manuring of soyabean is available, the present trial was laid out using EC 39821 (8-3) as test variety. The treatments included 5 levels of nitrogen, including rhizobium (Rhizobium inoculation was taken as a level of N) and 4 levels of P. The total number of treatments came to 20 (Table L.3). The plots treated with rhizobium did not receiv fertilizer nitrogen. Soyabean was dibbled at a spacing of 20 cm x 20 cm.

Nitrogen exerted linear increase in soyabean yield. The highest yield was produced by N @ 45 kg/ha. It was, however, on a par with rhizobium inoculation. Bacterial fertilisation, however, was significantly superior only to applied N at 15 kg/ha. Effect of phosphorus on bean yield was not significant. Similarly, the interactional effect of phosphorus with applied N also did not touch the level of statistical significance. Although phosphorus by itself did not contribute to increased yields, it tended to increase the efficiency of rhizobium or, conversely, response to P was increased by rhizobium inoculation.

Table L.3. Soyabean yield (kg/ha) as influenced by rhizobium, N and P

Nitrogen (kg/ha)	Grain yield	Phosphorus (kg/ha)	Grain yield	Interactional effect of rhizobium with P (kg/ha)
0	110	0	192	195
15	192	30	232	237
30	237	60	222	262
45	313	90	247	352
rhizobium	262	..	...	...
CD (0.05)	67			100

<u>Response of black gram to N,P and rhizobium inoculation</u>

Response of black gram to nitrogen and phosphorus and to bacterial fertilization was studied in a replicated trial. The treatments and the layout were essentially the same as for soyabean. A local variety was tried at a spacing of 20 cm x 15 cm.

The data on grain yield revealed no significant differences between the levels/nitrogen, phosphorus and their inter-/nc actional Bacterial fertilization did not effect any yield increase in black gram. However, response to phosphorus was seen increased by rhizobium inoculation (Table L.4). Similar results have been observed in cowpea and soyabean also.

Table L.4. Blackgram yield as influenced by nitrogen and phosphorus

Level of N (kg/ha)	Grain yield (kg/ha)	Level of P (kg/ha)	Grain yield (kg/ha)	Interactional effect of rhizobium with P
0	402	0	405	337
15	430	20	447	373
30	442	60	447	393
45	490	90	490	542
Rhizobium	412			
CD (0.05)	..		..	..

Breeding for high yielding cowpea

Sixty four progenies from the following cross combinations were selected for further testing in the next season. They are bushy in plant type possessing high yield potential.

Cross	Generation	No. of progenies selected
1. Calicut 51 x New Era	F6	23
2. Calicut 51 x Pusa Dofasli	F6	20
3. Calicut 51 x Kolingi payar	F6	6
4. New Era x Calicut-51	F6	12
5. Manjeri x New era	F4	1
6. Manjeri x Pusa Dofasli	F4	2

Germ plasm

Three hundred and sixteen varieties of different leguminous crops were maintained as genetic stock.

Cowpea	85	varieties
Black gram	45	,,
Green gram	48	,,
Soyabean	25	,,
Red gram	103	,,
Lab Lab	10	,,

SEED TESTING

A total number of 1562 samples of paddy seeds were analysed in the State Seed Testing Laboratory attached to this station. Of these samples, 188 numbers were received from the State Seed Farms, 310 numbers from the registered seed growers and 1064 numbers from the various rice research stations in the State.

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2. Gopalakrishnan, R. Rice cultivation in Kerala Yojana. 16 (10) : 399-401.

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5. Pillai, G.R., Nair, R.R., Pisharody, P.N. and Gopalakrishnan, R. Studies on the control of bronzing disease in rice. Technology. 10 (3,4): 310-311.

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7. Gopalakrishnan, R., Gopalan, N., George, K.M., Thomas, B. and Shanmughom, S.N. Occurance of 'Tungro' virus disease of rice in Kerala. Agricultural Research Journal Kerala. 11 (1) . 77 and also in Rice Pathology News letter 1/74 .4

8. Gopalakrishnan, R., Gopalan, N., George, K.M and Shanmughom, S.N. Grassy stunt epidemic in Kerala. Agricultural Research Journal, Kerala. (1. (1) 84

9. Thomas, B., Abraham, C.C., Karunakaran, K. and Gopalakrishnan, R. Relative susceptibility of different varieties of paddy to infestation by the angoumois grain moth Sitatroga cerallella Oliver as influenced by the amylose content of the endosperm Bull. Grain Technology 10 (4) 263-66.

10. Shanmughom, S.N., George, K.M., Gopalan, N. and Gopalakrishnan, R. Leaf scald of rice (Rhynchosporium oryzae). Current Science. 42 (16) 582-583

11. Gopalan, N. Brownhopper and grassy stunt epidemic in Kerala. Rice Pathology News letter. 1/74 17 .

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1. Gopalakrishnan, R. On high yielding rice varieties . Kalpadhenu. 1 (1) : 6-8.

2. Gopalakrishnan, R. Kerala marches forward in rice production. Kerala Karshakan. 20 (16) : 7-9

3. Gopalakrishnan, R. Rice and its origin. Kerala Karshakan. 20 (12). 5-7.

4. Gopalakrishnan, R. Brown planthopper. Kalpadhenu 1 (2): 3-4.

5. Pisharody, P.N. and Nair, R.R. Water in the life cycle of a rice plant. Kerala Karshakan. April, 1973.

EXTENSION ACTIVITIES

* demonstration plots to educate ryots for controlling brown planthopper.

* conferences, seminars, group discussions, Radio talks, Farm school on the air

* production and distribution of seeds

PLANT PROTECTION DEMONSTRATIONS IN THE KOLE LANDS OF TRICHUR

During the last three crop seasons wide spread damage due to infestation by brown planthopper was being experienced in the Kole rice fields. The methods of control adopted by the cultivators were not adequate to bring the pest under effective control. Hence, with a view to demonstrate the correct methods of plant protection for controlling the brown planthopper infestation and other pests and diseases in rice, a series of demonstrations were undertaken in the Kole rice fields during the puncha season of 1974. In all there were six demonstration plots distributed in the 6 N.E.S. Blocks in the region. The details regarding the location of the plots, the area of each plot, the number of participating cultivators and the rice variety used, are given below.

Sl. No.	Name of N.E.S. Blocks	Location	Area in acres.	No. of cultivators participated	Variety used
1.	Chowannur	Pullanichal	17.50	14	Annapurna
2.	Mullasseery	Thekkekonchira	25.00	26	-do-
3.	Anthikad	Anthikad	25.00	27	-do-
4.	Puzhakkal	Pullazhi	25.00	17	Thriveni
5.	Cherpu	Jubileepadavu	25.00	6	-do-
6.	Irinjalakuda	Muriyad	25.00	5	Annapurna

The calendar of plant protection operations prescribed for the demonstration plots is given below

i. Seed treatment with Furadan 3 G and Ceresan.
ii. Application of Furadan 3 G 20 days after sowing.
iii. Spraying Ekatox and Dithane Z.78 about 40 days after sowing
iv. Dusting B.H.C. 10% at the dough stage, if bug or brown planthopper incidence is noticed
v. Spraying Hinosan if blast or sheath blight symptoms are observed
vi. Spraying B.H.C. 5% or Sevin 50% or Ekatox against brown hopper if it appears.

The scheme was inaugurated by the Vice-Chancellor of the Kerala Agricultural University, Dr. C.M.Jacob, on 17th January, 1974. The staff of the Agriculture Department in the Trichur District also wholeheartedly co-operated with us. The results are presented below

Demonstration plot at Pullanichal

In this demonstration plot the general condition of the crop was satisfactory up to the maximum tillering phase. Thereafter the crop suffered a set back due to water scarcity. In some regions build-up of brown planthopper was in evidence. These areas were those receiving higher doses of nitrogen than the recommended dose of 60 lb. per acre. During the later phase of the demonstration, due to some local politics co-operation from the cultivators was lacking and the crop was harvested by the cultivators without informing the University.

Demonstration plot at Thekkekonchira

The crop suffered badly due to water scarcity from 15-3-1974 onwards. Weeding and top dressing could not be done due to this. As a result tillering and crop growth in general were poor. Brown planthopper was however under effective control.

Demonstration plot at Anthicad

In general the growth of the crop was satisfactory. During the boot leaf and flowering stages, the crop suffered due to water scarcity. But since showers were received later and water was available in the canals, the crop survived and could be harvested.

Demonstration plot at Pullazhi

In general the crop growth was satisfactory. Dry conditions existed from tillering to flowering and so weeding could not be done effectively. The crop growth improved with availability of irrigation water and the rains towards the later part of the crop.

Demonstration plot at Jubileepadavu

In general the crop was satisfactory.

Demonstration plot at Muriyad

In general the crop was satisfactory. In the second and third blocks where the sowing was done 10 days later than the first stunting of plants was observed.

YIELD

A comparative statement of the yields obtained in the demonstration plots and the surrounding area is furnished below.

Sl. No.	Location	Average yield in the demonstration plot (kg/ha)	Average yield in the surrounding area (kg/ha)
1.	Pullazhi in Puzhakkal Block	3660	2250
2.	Jubileepadavu in Cherpu Block	3360	1875
3.	Thekkekonchira in Mullassery Block	1365	665
4.	Anthikad in Anthikad Block	3100	1875
5.	Muriyad in Irinjalakuda Block	2000	1200

From Pullanichal in Chowannur Block the correct yield data could not be obtained as the harvesting was done by the cultivators without informing the staff.

Radio talks

This station worked in close collaboration with the All India Radio, Trichur and Calicut in the programme of dissimination of up to date information on the various aspects of rice cultivation to the farming community. Twenty one talks of our Scientists were broadcasted from these radio stations during the year.

Farm school on the ' AIR '

The All India Radio, Trichur in collaboration with the Kerala Agricultural University undertook the broadcast of a series of lessions on rice and its culture under the " Farm school on the AIR " programme during the year. The scripts of most of these lessions were prepared by our scientists.

Teaching

Post graduate students of Botany from Calicut University; St. Thomas College, Trichur; Maharaja's College, Ernakulam; Government Victoria College, Palghat; S.B.College, Changanacheery and University College, Trivandrum were given classes on rice breeding and genetics by our scientists.

Table M.2. PRODUCTION OF RICE IN THE RICE RESEARCH STATION, PATTAMBI DURING THE LAST 10 YEARS (tonnes)

Year	Seed				Bulk paddy	Grand total
	Virippu	Mundakan	Puncha	Total		
1964-65	34.629	28.318	2.104	65.051	27.829	92.880
1965-66	41.879	23.840	3.047	68.766	30.062	98.828
1966-67	25.278	24.697	--	49.975	31.231	81.206
1967-68	41.111	38.176	9.665	88.952	29.515	118.467
1968-69	33.420	44.191	8.063	85.674	39.518	125.192
1969-70	51.580	47.389	19.223	118.192	27.443	145.635
1970-71	43.436	33.291	8.947	85.674	46.446	132.120
1971-72	62.294	38.677	7.250	108.221	48.754	156.975
1972-73	67.208	50.543	5.400	123.151	36.044	159.195
1973-74	79.400	38.659	1.927	119.986	27.927	147.913

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