RICE
RESEARCH
STATION
PATTAMBI

# annual report

1975-76

C O N T E N T S

# I N T R O D U C T I O N

This is the fortynineth annual report of the Rice Research Station, Pattambi. It depicts the activities of the station from April 1975 to March 1976.

## Research highlights

Rice is cultivated under diverse ecological situations in Kerala. Each situation has problems peculiar to it. The modern dwarf rice varieties are unsuitable for many of these situations. The vast salty areas of coastal marshes, the low temperature regions of Wynad and High Ranges, the drought-prone uplands of the central and northern districts and the ill-drained, highly acidic lateritic soils of the southern districts demand varieties possessing tolerance to adverse ecological conditions. The thrust of the plant breeders, therefore, was to identify and develop varieties adapted to each of these rice growing environments.

Our rice breeders have identified a semitall, non-lodging variety with high yield potential for the rainfed uplands, where moisture and weeds are the major constraints to rice production. This variety - ARC 11775 - possesses all the important traits of an upland rice: high initial vigour, drought tolerance and good canopy development.

Breeding varieties resistant to salinity hazards has achieved considerable progress. From the mutant progenies of the popular saline resistant cultivar, Orpandy, our breeders have isolated several lines having salinity resistance and high yielding ability. These lines are now under concurrent evaluation in the saline marshes of Cannanore, Ernakulam and Alleppey districts.

Breeding high yielding varieties possessing genetic resistance to major insect pests and diseases was intensified during the year. Through interdisciplinary team approach, we could identify and develop several lines tolerant to brown planthopper, gall midge, blast, sheath blight and bacterial leaf blight. The cultures 1-5-4, 21592, MO 11,42-3-3, MO 21,30-1-1, MO 14-2-3, MO 9-50-2-2 and MN 793 are tolerant to brown planthopper, the cultures MO 11,42-3-3, MO 11,57-5-1, MO 9-59-2-1, MO 9-87-5, MO 17-34-4 and MN 79-60 are fairly resistant to gall midge and culture 2931 is resistant to all the major diseases.

Rice production technology under biophysical constraints was the avenue of research of the Agronomists. They have found that the present recommended dose of nitrogen can be reduced to half under adequate crop management including time and method of nitrogen application. They have also found that under limited availability of fertilizers, application of phosphorus and potash can be skipped over for one or two seasons without much sacrifice on grain yield in soils which contain moderate amounts of native phosphorus and potash.

Studies on phosphate nutrition of rice soils indicated that there was a critical limit of available phosphorus in the soils beyond which any addition of phosphatic fertilizer with the intention of increasing the availability of this nutrient, would only depress grain production. A detailed investigation is in progress to gather confirmatory informations.

Investigations on azotobacter, a source of natural nitrogen enrichment, did not yield any beneficial results. Addition of lime, molybdenum or supercompost or a combination of all these did not improve its efficiency.

In their studies on age of seedlings, Agronomists found that productivity of older rice seedlings could be increased by cultural practices like close spacing, shallow planting, bunch planting and weed control. They also observed that nitrogen played a more important role than plant population density, in increasing the productivity of older seedlings.

Physiological experiments on the effect of waterlogging at different growth phases of rice indicated that the tall variety, Mashoori could tolerate waterlogging during all the stages of growth.

Our Entomologists intensified their studies to find out biotype differences, if any, in the brown planthopper population in Kerala. Their research confirmed the earlier findings that the biotype of the brown planthopper found in Kerala is different from those observed in the Philippines. All the four varieties identified at the International Rice Research Institute, Philippines as having monogenic dominant resistance (as in Mudgo) or monogenic recessive resistance (as in Asd 7) to brown planthopper exhibited susceptible reaction in Kerala.

Only three cultivars have been found to be resistant to the biotype in our state. They are, Ptb.19, Ptb.33 and ARC 6650. The fact that all these three varieties reacted similarly to brown planthopper at Pantnagar, Rajendranagar and Cuttack goes to prove that there is no biotype difference in the brown planthopper populations in India.

The research workers in the Plant Pathology division directed their activities to identify varieties possessing 'built-in' resistance to the major rice diseases. Out of the one thousand two hundred and twenty nine entries tested in the national screening nursery, twenty seven showed resistant reaction to blast, brown spot and bacterial leaf blight. In the international rice testing programme, one hundred and twenty four entries were, evaluated for sheath blight resistance. 'Nang payah 132' was the only variety to exhibit resistant reaction against this disease. The varieties identified as resistant to diseases will be used as donors in the future breeding programmes.

A new project

A new project - BPH-GSV Complex - was initiated during the year with the main objective of combating the brown planthopper-grassy stunt complex, thanks to the generous financial assistance of the Ford Foundation, U.S.A. through the I[illegible]. The researchers in this project screened all the available breeding materials against brown planthopper under field and laboratory conditions and selected four hundred lines tolerant to this malady.

## Our visitors

The members of the Estimate Committee of the Kerala Legislative Assembly under the chairmanship of Sri.M.Ramappa, M.L.A., visited the station on 8, July, 1975.

Sri.R.J.Shard of the Australian National University called on us on 29, August, 1975 accompanied by Sri.S.B.Sahay of the planning Commission, Government of India.

Dr.Sukhdev Singh, Deputy Director General (crop sciences), Indian Council of Agricultural Research, New Delhi, visited the station on 9, September, 1975.

Dr.M.V.Rao, Project Coordinator (Wheat), Indian Council of Agricultural Research, New Delhi accompanied by Dr.K.B.L.Jain, Project Coordinator (Barley) and Dr.P.M.N.Nambisan, IARI Wheat Research Station, Wellington, visited the station on 28, September, 1975.

A team of members of the General Council of the Kerala Agricultural University paid a visit to the station on 22, October, 1975 and appreciated the good work done for the general improvement of rice culture in the state. The team comprised of M/S M.Janardanan Nair, Retired Director of Agriculture, E.K.Gopala Menon, P.K.Dewar, K.Janardanan Nair, V.Gopalakrishna Kurup and K.M.N.Kartha.

The Central Team on water utilization in Irrigation Projects visited on 26, November, 1975. M/S N.L.Sankaran, V.N.Nagaraj, S.L.Pandey and B.K.Baweja were the members of the team.

The Review Committee appointed by the Indian Council of Agricultural Research headed by Dr.J.S.Patel visited the station on 5, December, 1975. This was followed by the visit of a high power delegation of rice workers from the USSR on 7, December, 1975. The members of the delegation included Dr.V.A.Dzuba, Head of Genetics Laboratory, Dr.M.N.Davidov, Head of Mutagenisis Laboratory, All Union Rice Research Institute, Dinskoi Region, Krasnodar and Dr.V.N.Balabanow, Director, V.I.R. Experimental Station, Astrakhan.

The other important visitors to this station include Dr.A.W.Khan, Director, Farm & Home, All India Radio, New Delhi, (27, December 1975); Dr.K.N.Prasad, Director, Geological survey of India, Hyderabad (10 February, 1976); Dr.V.A.Dyck, Entomologist, International Rice Research Institute, Philippines; Sri.Henry P.Richards, CARE, United States of America.

Training

Dr.R.Gopalakrishnan, Rice Specialist participated in the international rice research conference from 12 April 1975 to 16 April, 1975 at the International Rice Research Institute, Philippines.

M/s M.Gopalan, Patholigist, K.I.James, Rice Breeder and B.Thomas, Research Officer (Entomology) returned from Philippines on 30 June, 1975 after undergoing training for a period of four months under the Genetic Evaluation and Utilization Programme.

Sri.V.P.Sukumara Dev, Research Officer, attended the Seed Testing Training Course at the Seed Technology Division, Indian Agricultural Research Institute, New Delhi for a period of 6 weeks from 15 March 1975.

## Staff changes

Consequent on the appointment of Dr.R.Gopalakrishnan as Director of Research, Kerala Agricultural University, Sri.M.Gopalan, Associate Professor (Plant Pathology), All India Co-ordinated Agronomic Research Project took charge as Rice Specialist on 23rd July, 1975.

Sri.A.E.S.Kurup, Entomologist, Sri.K.K.Vidyadharan, Agronomist and Sri.M.M.George, Research Officer (Pathology) were transferred to the other sister institutions under the University. These posts were filled up by promoting Sri.K.Karunakaran (Entomologist), Sri. P.J.Tomy (Agronomist) and Sri.P.K.Satyarajan (Research Officer).

Sri.N.R. Nair, Officer-in-charge of the All India Co-ordinated Agronomic Research Project assumed charge as Deputy Director (Rice), a post newly created, on 10th September, 1975. Dr. K. .Sukumaran took over as Officer-in-charge on the same day.

Sri. P.K.G.Menon, joined on 17th November, 1975 as Scientist Class I in the new project, 'disease and pest investigation'.

Sri.T.C.Radhakrishnan, Sri.Abdul Hameed and Sri. K.P.V.Nair, Junior Research Officers, rejoined duty after completing their post graduate training at the Agricultural College and Research Institute, Vellayani.

Sri.S.M.Shanmugham, Sri.Abdul Hameed, Sri.S. Seshadrinath, and Sri.E.R.Narayanan Nair were promoted respectively, as Junior Pathologist, Assistant Chemist, Research Officer (Chemistry) and Statistical Officer.

Dr.James Mathew, Dr.Abraham Thomas, Sri.Manikantan Nair and Sri. K.P.V. Nair joined, respectively as Junior Pathologist, Junior Agronomist, Junior Breeder and Junior Entomologist in the new project for evolving varieties resistant to brown planthopper-grassy stunt complex, financed by the Ford Foundation.

Rice production

Rice production touched a new peak during the year. The total production was 164.7 tonnes as against 152 tonnes during the previous year.

Finance

The total expenditure incurred on various schemes amounted to Rs. 11,56,423.27 during the year. The amounts spent on different important projects were as follows:

| | | |
|---|---|---|
| Research on Rice | : | Rs. 7,25,567.73 |
| Composite Farms | : | Rs. 2,13,232.09 |
| All India Coordinated Rice Improvement Project | : | Rs. 2,41,489.82 |
| All India Coordinated Agronomic Research Project (HQ Staff) | : | Rs. 83,576.17 |
| BPH-GSV Complex | : | Rs. 56,193.53 |
| Research on pulses | : | Rs. 45,764,74 |
| Seed Testing | : | Rs. 37,469.97 |
| Meteorology | : | Rs. 8,489.86 |
| Development of Regional Stations - equipments | : | Rs. 41,277.99 |
| Ford Foundation (screening trials at Muryad Kayal) | : | Rs. 5,379.37 |

The total receipts on account of sale of farm produce amounted to Rs. 2,77,299.68.

# CROP WEATHER

During the year 1975-76 (April-March), 3201 mm of rain were received compared with a 10 year average of 2643 mm. There were 131 rainy days. The highest rainfall of 176.5 mm in a single day occured on 21, June. The total hours of bright sunshine during the year were 2,242.8. The maximum temperature of 39.4°C was recorded on 1, April, 1975. The minimum temperature of 14.5°C was on 23, February, 1976.

The first crop season (April-September) was characterised by heavy rainfall and low light intensity. Most of the rain (2721 mm) fell during this season. The maximum precipitation was recorded in June; normally July is the peak month. The total hours of bright sunshine were 723 as against 951.5 in 1974-75 and 1128.4 in 1972-73. The production of rice did not touch the expected level during this cloudy and wet season probably because of low light intensity.

The second crop season (October-January) was highly favourable for crop growth and production. The precipitation that fell during this season amounted to 458 mm on 23 rainy days compared with the normal rainfall of 416 mm on 19 rainy days. The hours of bright sunshine were 926.4 in total. In spite of the sporadic incidence of case worm at the beginning of the crop season, rice production reached an all time record of 75.1 tonnes.

Table [illegible].1. Meteorological data for the year 1975-76

| Month | Rainfall (mm) | No.of rainy days | Mean max. temp. °C. | Mean minimum temp. °C | Relative humidity (%) | Total hrs. of bright sunshine |
|---|---|---|---|---|---|---|
| April 75 | 45.0 | 5 | 36.0 | 24.5 | 92 | 207.6 |
| May | 139.6 | 6 | 33.0 | 24.2 | 95 | 195.2 |
| June | 996.1 | 27 | 28.7 | 22.5 | 97 | 56.9 |
| July | 408.5 | 23 | 28.9 | 22.7 | 97 | 67.4 |
| August | 689.7 | 26 | 28.5 | 22.6 | 97 | 63.7 |
| September | 441.9 | 18 | 29.7 | 22.9 | 95 | 132.2 |
| October | 252.1 | 16 | 29.2 | 23.0 | 95 | 150.3 |
| November | 296.1 | 7 | 31.5 | 22.3 | 93 | 234.1 |
| December | .. | .. | 32.8 | 20.8 | 86 | 258.8 |
| January 76 | .. | .. | 32.1 | 20.0 | 76 | 283.2 |
| February | .. | .. | 35.2 | 19.8 | 82 | 29[illegible].3 |
| March | 22.4 | 1 | 36.8 | 2[illegible].4 | 91 | 303.1 |

# V A R I E T A L  I M P R O V E M E N T

Varietal improvement of upland rice

A semi tall plant type with moderatly long and droopy leaves is better adapted to upland rice culture since it can compete effectively with weeds. The traditional upland varieties are tall and vigorous but they are prone to lodging at the flowering phase. This has necessitated to identify nonlodging semi tall varieties with high yield potential and drought tolerance for the rainfed uplands. Two projects were, therefore, initiated during the year with this objective in view.

Ag.1.1.5.1.

Comparative yield trial of ARC cultures

roduction performance of seven ARC cultures and 3 IARI selections was evaluated under upland conditions during the first crop season (Table 3.1.) The tall cultivar Ptb.28 and the dwarf high yielding strain, Jyothi were used as check varieties. All the test varieties were direct seeded under dry conditions at a spacing of 15 cm x 15 cm.

ARC 11775 and ARC 11478 exhibited excellent seedling vigour, an essential trait for upland rice. They were as tall as Ptb.28, but never did they lodge. ARC 11775 proved to be the most productive of all, recording 19.2 percent increase in grain yield over the tall check variety, Ptb.28. Both of them were equal in growth duration.

All the test entries registered significantly higher yields over Jyothi under the stress conditions in the uplands.

Ag.1.1.5.2.

New early duration cultures for uplands

In this trial seven early duration rice cultures were evaluated for yield potential and drought tolerance under rainfed upland condition. The cultures were, 23332-2, 23372, 23548,

Table 3.1. Comparative performance of ARC and IARI cultures; first crop, 1975-76.

| Culture/variety | Duration (days) | Grain yield (kg/ha) | Increase or decrease over Ptb.28 (%) |
|---|---|---|---|
| ARC 11980 | 108 | 2040 | -12.8 |
| 11457 | 105 | 1710 | -24.0 |
| 11748 | 105 | 2055 | -8.0 |
| 11775 | 105 | 2666 | +19.0 |
| IARI 7046 | 105 | 1882 | -16.0 |
| 11295 | 105 | 2248 | +1.0 |
| 11094 | 103 | 1112 | -50.0 |
| Ptb.28 | 105 | 2236 | - |
| Jyothi | 115 | 683 | -69.0 |
| CD (0.05) | | 690 | |

23631-1, 7944, 21592 and IET 1444. Ptb.28 and Thriveni were used as check varieties.

The culture 7944 recorded the highest yield of 2617 kg per ha, the increase in production being 19.0 percent over Ptb.28. The difference between the varieties, however, was not statistically significant (Table 3.2).

Ag.1.1.5.3.

Breeding for cold tolerance

Low temperature is a major factor that limits the adoption of improved varieties in the high altitude regions of Wynad and High Ranges in Kerala. Varieties suitable to these regions should have cold tolerance during the vegetative and reproductive phases. In order to breed a variety suitable for low temperature regions, IR8 was crossed with the cold resistant Hungarian Cultivar, Dunghansbali in 1974-75. The progenies were grown in the Horticultural Research Station, Ambalavayal (Wynad) from the F3 generation onwards.

Table 3.2. Yield potential of early duration cultures; first crop, 1975-76.

| Culture./variety | Duration (days) | Grain yield (kg/ha) |
|---|---|---|
| 23332-2 | 119 | 1503 |
| 23372 | 119 | 1832 |
| 23548 | 119 | 1992 |
| 23634-1 | 119 | 1808 |
| 7944 | 108 | 2617 |
| 21592 | 119 | 2175 |
| IET 1444 | 117 | 1820 |
| Ptb.28 | 108 | 2199 |
| Thriveni | 108 | 1539 |
| F (0.05) | | NS |

During the first crop season of the current year twenty two lines were grown and 53 single plants were selected based on their reaction to cold weather. From among these, 21 top yielders were advanced to a preliminary yield trial in the second crop season. Five cultures possessing good yield potential and cold weather tolerance were finally selected from this trial for further evaluation during 1976-77.

Ag.1.1.5.4.

Breeding for improvement of 'Orpandy' rice

'Pokkali' or 'Kaipad' rice fields are typical saline areas in Kerala and comprise of low-lying marshes situated near the mouths of streams and rivers. Reclamation of these lands by chemical amendments is too expensive and often impracticable. The varieties now raised in these unproductive lands are Orpandy, Orkayama, Pokkali, Jali and so on. Whilst these cultivars are salt tolerant, they are poor yielders. A project was, therefore, undertaken during 1973-74 to improve the production potential of the popular saline resistant cultivar 'Orpandy' by mutation breeding.

Seeds of Orpandy were irradiated with 2 doses of gamma rays (11 Kr and 32 Kr) in 1973-74 and the mutant progenies were evaluated in the subsequent years.

During the second crop season of 1975-76, 138 awnless mutants were raised as progeny rows at Pattambi and top yielders were selected. These materials were concurrently evaluated for salinity resistance in the 'Orumundakan' lands in Muthukulam. Seventysix lines showed salinity tolerance and from these, 264 single plants were selected for further screening under salinity hazards at Muthukulam.

Ag.1.1.5.5.

<u>Methods of sowing in rainfed uplands</u>

This experiment was initiated to study the possibility of adopting wide spaced flowline seeding in the rainfed uplands with the main objective of early and thorough weed control.

Table 3.3. Grain yields of rice varieties as influenced by methods of seeding.

| Treatment | | Grain yield (kg/ha) | Mean of varieties (kg/ha) |
|---|---|---|---|
| Jyothi, 15 cm x 15 cm dibbling | | 1722 | |
| Ptb.28, | -do- | 1698 | |
| Thriveni, | -do- | 1436 | 1619 |
| Jyothi, 45 cm spaced flowline | | 1246 | |
| Ptb.28, | -do- | 1574 | |
| Thriveni, | -do- | 1057 | 1292 |

Two methods of sowing were compared: dibbling at 15 cm x 15 cm and flowline seeding in 45 cm rows. The test varieties were Jyothi, Ptb.28 and Thriveni.

The stand of the crop in the experimental plots was not uniform because of moisture stress. The data cannot therefore be relied upon. All the varieties produced more yields, under 15 cm x 15 cm dibbling than under 45 cm flowline seeding. The difference between the methods of sowing was 327 kg per ha on an average of the varieties tested. The data are presented in Table 3.3.

Ag.1.1.5.6.

Comparative yield trial of medium duration rices

Nine mid duration rice cultures developed by hybridization and selection (Mashoori x Sabari; Co 25 x IR 262 and Taichung (Native 1) x Co 25) were yield tested under 2 levels of fertility (80:40:40 and 40:20:20) during the first and second crop seasons of the current year. Bharathy, IR 8 and Jaya were used as check varieties.

The varietal differences touched the level of statistical significance at the high fertility level only. None of the nine cultures, however, showed higher yield potential over the popular varieties Jaya, IR 8 and Bharathi during the first crop season. In the second crop season, the cultures 22641 (Mashuri x Sabari), 1-5-4, 925, 1012 and 1018 (T(N)1 xCo 25) produced significantly higher yields over Bharathy, but they were not superior to IR 8 and Jaya (Table 3.4.).

Under the low fertility level, the cultures 1-5-4 and 23178 showed good promise.

The cultures 1012 and 1018 were dropped and the rest of them were grouped into three ie, tall early (22641, 22651-2); tall medium (23098-1, 925) and dwarf medium (23178, 1-5-4, 1065) for further evaluation during the next year.

Table 3.4. Grain yields of mid duration cultures under comparative yield trial

| Culture | Cross | Mean grain yield (kg/ha) | | | |
|---|---|---|---|---|---|
| | | NPK 80:40:40(kg/ha) | | NPK 40:20:20kg/ha | |
| | | First crop | Second crop | First crop | Second crop |
| 22641 | Mashoori/Sabari | 3649 | 3704 | 2090 | 3105 |
| 22651-2 | ,, | 1925 | 3013 | 3016 | 2914 |
| 23098-1 | Co.25/IR 262 | 1799 | 3050 | 3360 | 2977 |
| 23178 | IR 8/Co 25 | 2815 | 3304 | 3851 | 3068 |
| 1-5-4 | TN1/Co.25 | 3179 | 3794 | 3888 | 3558 |
| 925 | ,, | 1126 | 3794 | 3524 | 2814 |
| 1012 | ,, | 2706 | 3958 | 4081 | 3522 |
| 1018 | ,, | 2343 | 3612 | 3016 | 3358 |
| 1065 | ,, | 3561 | 3086 | 4142 | 2777 |
| Bharathy | Check | 4360 | 2996 | 3924 | 2868 |
| IR-8 | ,, | 4360 | 3576 | 3270 | 2977 |
| Jaya | ,, | 1760 | 4194 | 3640 | 3304 |
| CD(0.05) | | 1926 | 566 | N.S. | N.S. |

Ag.[illegible].1.5.7.

Yield trial of early duration cultures

Yield potentials of 6 early duration rice cultures were assessed in a comparative yield trial during the first and second crop seasons using Thriveni, Jyothi and Annapoorna as check varieties (Table 3.5.).

The cultures, 4320, 4102 and4392 produced grain yields above 4 tonnes per ha during the first crop season although none of them were significantly superior to the high yielding check variety, Jyothi. Thriveni and Annapoorna recorded poor yields compared with these cultures. The only culture to record significantly higher yield potential over Jyothi was 23518 (induced mutant of MN 54-42) during the second crop season. It registered 29.7 per cent more yield over the latter. This mutant is fairly tolerant to blast also.

Table 3.4. Grain yields of mid duration cultures under comparative yield trial

| Culture | Cross | Mean grain yield (kg/ha) | | | |
|---|---|---|---|---|---|
| | | NPK 80:40:40(kg/ha) | | NPK 40:20:20kg/ha | |
| | | First crop | Second crop | First crop | Second crop |
| 22641 | Mashoori/Sabari | 3649 | 3704 | 2090 | 3105 |
| 22651-2 | ,, | 1925 | 3013 | 3016 | 2914 |
| 23098-1 | Co.25/IR 262 | 1799 | 3050 | 3360 | 2977 |
| 23178 | IR 8/Co 25 | 2815 | 3304 | 3851 | 3068 |
| 1-5-4 | TN1/Co.25 | 3179 | 3794 | 3888 | 3558 |
| 925 | ,, | 1126 | 3794 | 3524 | 2814 |
| 1012 | ,, | 2706 | 3958 | 4081 | 3522 |
| 1018 | ,, | 2343 | 3612 | 3016 | 3358 |
| 1065 | ,, | 3561 | 3086 | 4142 | 2777 |
| Bharathy | Check | 4360 | 2996 | 3924 | 2868 |
| IR-8 | ,, | 4360 | 3576 | 3270 | 2977 |
| Jaya | ,, | 1760 | 4194 | 3640 | 3304 |
| CD(0.05) | | 1926 | 566 | N.S. | N.S. |

Ag.[illegible].1.5.7.

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Table B.5. Grain yields of early duration cultures under comparative yield trial.

| Culture | Cross | Mean grain yield (kg/ha) First crop | Second Crop |
|---|---|---|---|
| 23332-2 | Induced mutant of MN 54-42 | 4320 | 2434 |
| 23372 | ,, | 4102 | 2794 |
| 23548 | ,, | 4392 | 3703 |
| 21592 | ,, | 2794 | 2973 |
| 23634-1 | Annapoorna x Leb Mue Nahng | 3454 | 2986 |
| 7944 | Thriveni x Taichung (N)1 | 3731 | 2255 |
| Jyothi | Check variety | 4000 | 2857 |
| Thriveni | ,, | 2486 | 2486 |
| Annapoorna | ,, | 2885 | 1884 |
| CD (0.05) | | 1064 | 734 |

Ag.1.1.5.8.

Pedigree rows

Seven hundred and fifty three lines developed from various crosses involving parents with high yield potential and pest resistance were evaluated in pedigree rows during the year. From these lines, 393 single plants were selected based on plant performance (Table B.6.).

Table B.6. Number of single plant selected

| Season | No.of lines grown | No.of single plants selected |
|---|---|---|
| First crop | 229 | 131 |
| Second crop | 401 | 132 |
| Third crop | 125 | 130 |
| Total | 755 | 393 |

## Varietal Improvement work under the All India Coordinated Rice Improvement Project.

### Uniform variety trials

Three uniform variety trials were conducted during the year with the object of identifying high yielding varieties. They were designated as UVT 1a, UVT 1 and UVT 2.

### Uniform variety trial 1a

Twenty two entries were yield tested against the check varieties, Bala and Cauvery during the first crop season. The trial was direct-seeded in 15 cm flow lines under semi dry conditions.

Table 3.9. Composition of UVT 1(a) and grain yield; first crop, 1975-76

| IET No | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 1722 | Pusa 4-1-11 | IR 8 x Tadukan | 3951 |
| 2222 | C 7306 | IR 19 x T(N)1 | 3889 |
| 2361 | RP 79-5 | IR 8 x N 22 | 3889 |
| 2662 | C 12329 | IJ 52 x T(N)1 | 4691 |
| 2913 | RP 79-13 | IR 8 x N 22 | 4321 |
| 2914 | RP 79-14 | ,, | 4444 |
| 2922 | RP 79-22 | ,, | 3951 |
| 2921 | RP 79-21 | ,, | 1136 |
| 3227 | CR 111-1004-1-191 | (N22 x TN1) x(T90xIR8) | 3506 |
| 3226 | CR 111-1091-2-192 | ,, | 3519 |
| 3316 | CR 113-71 | NSJ 200x Padma | 3704 |
| 3322 | CR 113-84-2 | ,, | 3519 |
| 3323 | CR 125-12-8 | (T 418 x MTU 17) x TN1 | 5285 |
| 3324 | CR 125-12-17 | ,, | 1198 |
| 3325 | CR 125-30 | | 1639 |
| 3326 | CR 131-9 | Bala x ADT 27 | 3457 |
| 3327 | CR 131-38-3 | ,, | 2840 |
| 3328 | CR 131-90-21 | ,, | 4639 |

contd.....

Table 3.9 contd..

| | | | |
|---|---|---|---|
| 3329 | CR 142-3-2 | Bala x Ch 45 | 3889 |
| 3330 | CR 142-3-8 | ,, | 3580 |
| 3331 | CR 143-2-10 | ,, | 3951 |
| 2173 | RP 79-9 | IR 8 x N 22 | 3765 |
| | Bala | | 3877 |
| | Cauvery | | 3642 |
| | F (0.05) | | N.S. |

Table 3.10. Composition of UVT 1(a) and grain yield; second crop, 1975-76.

| IET No | Designation | Flowering duration (days) | Grain yield (kg/ha) |
|---|---|---|---|
| 2222 | C 7306 | 70 | 3272 |
| 2361 | RP 79-5 | 67 | 5864 |
| 2173 | RP 79-9 | 66 | 5741 |
| 1662 | C 12329 | 72 | 4506 |
| 2684 | OR 34-16 | 68 | 5000 |
| 2924 | RP 79-24 | 70 | 6235 |
| 3322 | CR 113-84-2 | 64 | 4630 |
| 3325 | CR 125-30 | 72 | 5185 |
| 3329 | CR 142-3-2 | 67 | 4938 |
| 3330 | CR 142-3-8 | 64 | 4259 |
| 3331 | CR 142-2-10 | 71 | 5617 |
| 2914 | RP 79-14 (Check) | 72 | 5926 |
| | CD (0.05) | | 847 |

The flowering duration of the entries ranged from 75 days for IET 3330 to 93 days for IET3327 while Bala and Cauvery took, respectively, 82 days and 92 days to flower. The only entry to record higher yields over Bala was IET 3323. It yielded 4877 kg per ha which was equivalent to a grain yield of 46.8 kg per ha per day. The difference between these varieties, however, was not statistically significant (Table 3.9.)

During the second crop season, the number of test entries were reduced to 12 (Table B.10) including the check variety RP 79-14 (IET 2914). IET 2924 (100 days) was the top yielder in this trial although it was on par with the check variety (102 days) in yield potential. This slender grained variety recorded a productivity of 62.35 kg of grain per ha per day as against 58.09 kg of grain per ha per day recorded by RP 79-14 (Table B.10).

Ag.1.1.5.13.

Uniform variety trial 1

Performance of mid duration selections in the advanced stages of breeding was studied in this trial.

During the first crop season, 23 entries including 3 check varieties (Kakatya, Ratna, Cauvery) were planted under high fertility conditions adopting a randomised block design. The spacing adopted was 15 cm x 15 cm.

Three entries recorded equal yields during the season (Table B.11). They were IET 2815, IET 3127 and IET 4554 (IR 28). IET 4554 was the earliest among these 3 with a flowering duration of 92 days. The entries which recorded a grain yield of above 5 tonns per ha included IET 2707, IET 2813, IET 2815, IET 3126, IET 3127, IET 3138, IET 3310, IET 4554, IET 4555 and the check variety, Ratna. None of these entries were significantly superior to Ratna, however.

In the trial conducted during the second crop season 17 entries were evaluated using Annapurna, Cauvery and Thriveni as check varieties (Table B.12). The flowering duration of these entries ranged from 82 days (IET 4554) to 104 days (IET 2923 A). The check varieties took, respectively, 85 days 78 days and 90 days to flower.

Table 3.11. Composition of UVT 1 and grain yield; first crop, 1975-76.

| IET No. | Designation | Cross | Grain yield(kg/ha) |
|---|---|---|---|
| 819 | 8585 | T(N)1 x Co.29 | 4895 |
| 1441 | RP 28-849 | ,, | 4913 |
| 2213 | Kumar | T 90 x IR 8 | 4406 |
| 2215 | OR 10-136 | ,, | 4580 |
| 2477 | RP 5-46 | GEB 24 x T(N)1 | 3497 |
| 2507 | RP 271-43-7-5 | IET 728 x Khataribhog | 4930 |
| 2626 | RP 5-59 | GEB 24 x T(N)1 | 3741 |
| 2707 | MTU 6368 | IR 8 x Ch 45 | 5105 |
| 2813 | RP 6 516-33-6-1 | TKM 6 x IR 8 | 5070 |
| 2815 | RP 6 516-34-1-8 | TKM 6 x IR 8 | 5507 |
| 2830 | RP 6-590-22-5-4-1 | ,, | 4808 |
| 2845 | RP 319-34-8-1-3 | T 141 x IR 661-1-175 | 4703 |
| 2923 | RP 79-23-1 | IR 8 x N 22 | 3671 |
| 2960 | CR 126-42-1 | Dhungansali x IR 8 | 4441 |
| 3125 | PAU 125-1-2 | IR 579-48-1-2 x IR 747-B2-6-3 | 4790 |
| 3126 | PAU 125-228-3 | ,, | 5297 |
| 3127 | RP 6-516-31-4 | TKM 6 x IR 8 | 5507 |
| 3138 | Anupama | | 5210 |
| 3262 | RP 633-9-5-8-1 | (IR 8 x BJ1-13) x IR 22 | 4108 |
| 3319 | IR 1561-228-3-3 | IR8/Tadukan/TKM6/T(N)1 | 5155 |
| 4551 | IR 28 | Peta 3/TN1/Gampai-15/4/IR8/Tadukan/TKM 62/TN1/IR 24/*O. nivara* | 5507 |
| 4555 | IR 2071-625-1 | IR8/Tadukan/TKM24/TN1/IR 24/*O. nivara* | 5402 |
| | Kakatya | | 4388 |
| | Ratna | | 5087 |
| | Cauvery | | 3916 |
| | CD (0.05) | | 560 |

Table B.12. Flowering duration and grain yields of entries in UVT-1; second crop season, 1975-76.

| IET No. | Designation | Flowering duration (days) | Grain yield (kg/ha) |
|---|---|---|---|
| 1114 | RPCB 23-84 | 84 | 4889 |
| 2707 | MTU 6368 | 86 | 4497 |
| 2813 | RP 6-516-33-6-1 | 93 | 3634 |
| 2815 | RP 6-516-34-1-8 | 94 | 3791 |
| 2815 | RP 6-189-25-4- | 93 | 3242 |
| 2881 | RP 319-34-8-1-3 | 93 | 3608 |
| 2923 A | RP 79-23 A | 104 | 1490 |
| 2967 | CR 115-76 | 83 | 3556 |
| 3116 | RP 6-51-31-6 | 86 | 2327 |
| 3125 | PAU 125-1-2 | 89 | 4784 |
| 3126 | PAU 125-228-3 | 89 | 3477 |
| 127 | RP 6-516-31-4 | 88 | 4519 |
| 3202 | RP 633-9-5-8-1 | 88 | 3948 |
| 3219 | IR 1561-228-3-3 | 89 | 4261 |
| 4551 | IR 28 | 82 | 4627 |
| 4553 | IR 2071-625-1 | 89 | 4441 |
| 556 | IR 2071-625-1 | 84 | 4706 |
| | Anupama | 85 | 2876 |
| | Cauvery | 78 | 2693 |
| | Thriveni | 90 | 4235 |
| | CD (0.05) | | 985 |

The highest yielder in this trail was IET 1111 (4889 kg/ha). IET 3125 ranked second (4781 kg/ha). Although both these varieties produced significantly higher yields over Anupama and Cauvery, they were statistically on par with Thriveni which yielded 3235 kg of grain per ha. The top yielders in the first crop season - IET 4554, IET 3127 and IET 2815 - occupied, respectively, the fourth, fifth and eleventh ranks in grain production.

The data are presented in Table B.12.

Ag.1.1.5.16.

## Uniform variety trial 2.

The uniform variety trial 2 was conducted during both the seasons of 1975-76 in order to compare mid duration rices in the advanced stages of breeding. Twenty eight entries were tested in the first crop season as against 24 entries in the second crop season. The design of the trial was randomised block with 4 replications. The test varieties were transplanted at a spacing of 25 cm x 15 cm during both the seasons.

The grain yields of the entries ranged from 3059 kg per ha (IET 2147) to 4671 kg per ha (IET 2278) in the first crop season. Jaya, the check variety, recorded 3931 kg per ha and occupied the 9th rank in production. Eight entries produced higher yields than Jaya, but only one - IET 2278 - proved to be significantly superior to it. With long bold grains, this elite entry registered 11.9 percent increase in yield over Jaya. In terms of productivity per day, IET 2278 yielded 35.4 kg per ha compared with 27.9 kg per ha recorded by Jaya. The former was 9 days shorter than the latter in flowering duration.

The results are presented in Table 3.13.

Table 3.13. Composition of UVT 2 and grain yield corresponding to different entries, first crop, 1975-76.

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 1651 | RPK 6 3-11 | IR 8 x Dhadas | 4145 |
| 1785 | RP 811-39-1 | IR8/2 x Sigadis | 4243 |
| 1872 | OR 5-11 | T 141- x IR 8 22/6 | 3734 |
| 2080 | J 3-756 | | 3964 |
| 2147 | RP-4-5 | T 90 x IR 8 | 3059 |
| 2246 | RP - 79-2 | IR 8 x M 22 | 3437 |
| 2278 | C 24670 | SLO 13 x IR 8 | 4671 |
| 2295 | CR 12-178 | IR 8 x CR 1014 | 3833 |
| 2300 | CR 115-17 | CI 9524 x CR 24 | 3437 |

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| | | | |
|---|---|---|---|
| 2397 | RP 143-4 | HR 19 x IR 8/2 | 3520 |
| 2501 | C 24263 | IR 8/2 x (Peta x B.P) | 3684 |
| 2570 | IR 8 M 16 | IR 8 Mutant | 3734 |
| 2578 | R 1905 | R7 x T(N)1-6 | 3454 |
| 2595 | R 1913 | Co 29 x IR 8-1-2-4 | 3421 |
| 2655 | RP 189-3 | DGWG x T 141 | 3325 |
| 2565 | RP6-50-22-6-4-3- | TKM 6 x IR 8 | 3317 |
| 2864 | Pusa 5-2-3-8-1-2 | (IR8 x Peta/5) x B.P | 3257 |
| 2877 | BK 284 | IR 8 x T3 | 4359 |
| [illegible] | RP 9-4 | IR 8 x [illegible] 1251 | 3339 |
| [illegible] | BK 7 | T 3 x DGWG | 3947 |
| [illegible] | FH 132 | T(N)1 x Kashi | 4062 |
| [illegible] | PAU 24-1 | Hybrid 27 x Mutant 65 | 3635 |
| | IR 26 | | 3487 |
| | Satya | | 3273 |
| | Surya | | 3766 |
| | Suhasini | | 4490 |
| [illegible] | RP 4-14 | | 3849 |
| | CD (0.05) | | 695 |

Two entries recorded higher yields than Jaya during the second crop season. They were IET 3095 and IET 2991. The differences between these varieties, however, were not significant. All the other varieties tested were inferior to Jaya although most of them recorded yields above 6 tonnes per ha. The grain yield data are presented in Table B.14.

Table B.14. Grain yield corresponding to different entries in UVT 2; second crop, 1975-76

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 2216 | RP 79-2 | IR 8 x N 22 | 6626 |
| 2251 | RP 4-14 | T 90 x IR 8 | 4861 |
| 2490 | C 8054 | IR 8 x NP 130 | 6510 |
| 2530 | RP 260-750-3 | IR 8 x Latisail | 6221 |
| 2570 | IR8 M 16 | IR8 Mutant | 6510 |
| 2595 | R 1913 | Co 29 x IR 8-1-2-4 | 7234 |
| 2655 | RP 189-3 | DGWG x T 141 | 5150 |
| 2656 | RP6-590-22-6-4-3 | TKM 6 x IR 8 | 5006 |
| 2830 | RP6-590-22-5-4-1 | ,, | 5729 |
| 2864 | Pusa 5-2-3-8-1-2 | (IR8 x Peta/s) x B.P | 6597 |
| 2877 | BK 284 | IR 8 x T3 | 6655 |
| 2895 | RP 9-4 | IR 8 x W 1251 | 6424 |
| 2991 | CR 41-149-2-1051 | TKM 6 x IR 8 | 7610 |
| 2993 | CR 118-5 | (Tikku 132 x N22)SR 263 | 7089 |
| 2995 | BK 7 | T3 x DGWG | 6684 |
| 3001 | FH 132 | T(N)1 x Kashi | 6568 |
| 3005 | CR 129-118 | IR8/2 x LZN | 8304 |
| 3093 | RP6-516-29-1 | TKM 6 x IR 8 | 5613 |
| 3139 | TAU 24-1 | Hybrid 27 x M 65 | 6395 |
| 3365 | RP 268-31-3-1 | IET 728 x T 812 | 6887 |
| 3366 | OR 8-267 | T 141 x IR 8 - 246 | 4543 |
| | IR 26 | | 5642 |
| | Jaya | | 7350 |
| | Sona | | 6192 |
| | CD (0.05) | | 1300 |

Ag.1.1.5.9.

## Preliminary variety trial 1 a

In this trial, disignated as PVT 1a, early maturing selections from breeding materials generated at the cooperating centres in India were evaluated in order to identify varieties possessing high yield potential.

Table 3.15. Composition of PVT 1a and grain yield recorded by the entries; first crop, 1975-76.

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 2135 | C 7711 | IR 262 x ADT 27 | 3681 |
| 2441 | CR 115-102 | C1 9524 x CR 24 | 4375 |
| 2473 | RP 79-9 | IR 8 x N 22 | 4585 |
| 2682 | OR 34-6 | TKM 6 x T(N)1 | 1653 |
| 2684 | OR 34-16 | ,, | 4097 |
| 2685 | OR 34-21 | ,, | 2569 |
| 2715 | MTU 6225 | O[illegible] 8 x Ch 15 | 4861 |
| 2932 | CR 126-12-3- | Dhungansali x IR 8 | 3611 |
| 3268 | C 633 | Cul.340 x Kanchi | 3819 |
| 3269 | C 688 | Cul.340 x IR 262 | 5208 |
| 3270 | C 1305 | Co.29 x Cul.340 | 556 |
| 3271 | C 1977 | IR 8 x Cul.2410 | 4097 |
| 3272 | C 3219 | ADT 3 x IR 8 | 4593 |
| 3273 | C 3810 | Manila x IR 22 | 625 |
| 3274 | OR 45-61-23 | T 141 x T(N)1 | 1042 |
| 3275 | C 13206 | | 4097 |
| 3283 | CR 148-1056-200 | CR 141 x Pusa 2-21 | 3958 |
| 4106 | CR 155-5039-217 | Cauvery x {(Baok x N 22)x Red} | 4583 |
| 4107 | CR 155-5039-217 | ,, | 3958 |
| 4111 | RPA 5824 | | 5278 |
| 4112 | CR 153-5001-203 | IR 22 x IR 127 | 3611 |
| 3913 | RP 79- 43 | IR 8 x N 22 | 3542 |
| | CD (0.05) | | 1791 |

Twenty one selections were tested during the year using RP 79-13 and Bala as check varieties, respectively, during the first and second crop seasons (Table 3.15).

During the first crop season, flowering duration of the cultures ranged from 62 days (IET 2444) to 101 days (IET 3268, IET 3269). The check variety flowered in 57 days. Eleven cultures produced grain yields of over 4 tonnes per ha, but statistically, all of them were on par with the check variety, which yielded 3542 kg per ha. Among these elite cultures, IET 4111 ranked first in production potential with a mean yield of 5278 kg/ha (Table 3.15) which was equivalent to a production of 18.4 kg of grain per ha per day. The check variety produced 10.4 kg per ha per day.

A general decline in growth duration was observed in all the test entries during the second crop season. The entries 2435 and 2685 flowered in 55 days while the top yielder in the first crop season took 63 days to flower. The check variety Bala came to flower in 66 days.

The only entry to exhibit significantly higher yield potential over Bala was IET 4112 (Table 3.16). It produced a grain yield of 4938 kg per ha while Bala yielded only 3457 kg per ha. This culture also produced the overall highest yield in the trials conducted all over India. The top ranking entry in the first crop season failed to express its full yield potential during the hot second crop season. It registered an yield of only 2901 kg per ha.

Table 3.16. Summary of grain yields of entries in PVT 1a; second crop, 1975-76.

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 2435 | C 7711 | IR 262 x ADT 27 | 2407 |
| 2441 | CR 115-102 | C1 9524 x CR 24 | 3889 |
| 2683 | OR 34-7 | TKM 6 x T(N)1 | 3210 |
| 2684 | IR 34-16 | ,, | 1420 |
| 2685 | OR 34-21 | ,, | 3148 |
| 2715 | MTU 6225 | IR 8x Ch 45 | 3827 |
| 2932 | CR 126-42-3 | Dhungunsali x IR 8 | 1420 |
| 3268 | C 633 | Cul.340 x Kanchi | 3704 |
| 3269 | C 688 | Cul. 340 x IR 262 | 3642 |
| 3270 | C 1305 | Co.29 x Cul. 340 | 3148 |
| 3271 | C 1977 | IR 8 x Cul.2410 | 4136 |
| 3272 | C 3249 | ADT 3 x IR 8 | 2840 |
| 3275 | C 13206 | | 3778 |
| 3280 | CR 126-12-5 | Dhungunshali x IR 8 | 3157 |
| 4097 | PR 92 | | 3272 |
| 4106 | CR 155-5029-216 | Cauvery x (Baok x N 22) x Red 1 | 1975 |
| 4107 | CR 155-5029-217 | ,, | 1235 |
| 4111 | RPA 5821 | | 2901 |
| 4112 | CR 153-5001-202 | | 1938 |
| 2911 | RP 79-11 | | 2901 |
| | Bala | | 3457 |
| | CD (0.05) | | 1190 |

Ag.1.1.5.11.

Preliminary variety trial 1

This experiment was conducted during the first and second crop seasons with a view to evaluate the production potentials of short term rice selections promoted after initial testing in the national breeding nursery (NBN).

Forty seven entries were tested during the first crop season along with Ratna, the standard check. The entries were:-

| | | |
|---|---|---|
| IET 2671 | IET 3129 | IET 3622 |
| ,, 2673 | ,, 3131 | ,, 3626 |
| ,, 2681 | ,, 3132 | ,, 3627 |
| ,, 2683 | ,, 3138 | ,, 3629 |
| ,, 2687 | ,, 3276 | ,, 3630 |
| ,, 2689 | ,, 3277 | ,, 4097 |
| ,, 2700 | ,, 3278 | ,, 4098 |
| ,, 2706 | ,, 3279 | ,, 4099 |
| ,, 2720 | ,, 3280 | ,, 4100 |
| ,, 2742 | ,, 3281 | ,, 4101 |
| ,, 2762 | ,, 3282 | ,, 4102 |
| ,, 2764 | ,, 3284 | ,, 4103 |
| ,, 2765 | ,, 3295 | ,, 4105 |
| ,, 2766 | ,, 3296 | ,, 4108 |
| ,, 2767 | ,, 3298 | ,, 4556 |
| ,, 3128 | ,, 3621 | Ratna |

Flowering duration of the entries ranged from 83 days (IET 4097) to 104 days (IET 3281, IET 4092). The check variety took 97 days to flower. The entries therefore can be considered as mid duration varieties.

IET 2766 (124 days) topped the test varieties in grain production with an yield of 5547 kg per ha. Twelve entries were statistically on par with IET 2766. They were, IET 2671, 2706, 2742, 3132, 3277, 3281, 3281, 3296, 3626, 3629, 3630 and 4094. Nevertheless, only 3 entries (IET 2766, IET 3281 and IET 3296) proved to be significantly superior to the check variety, Ratna in production potential. These entries registered, respectively, 31.5 percent, 24.1 percent and 24.1 percent increase in yield over Ratna.

Summary of grain yield recorded by the elite entries in this trial are furnished in Table 3.17.

Table 3.17. Yield potentials of elite entries in PVT 1; first crop season, 1975-76.

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 2671 | MTU 6544 | IR 8 x Ch 45 | 4922 |
| 2706 | MTU 5116 | IR 8 x Ch 45 | 4844 |
| 2742 | 27033 | [T 712 x T(N)1] IR 35 | 4844 |
| 2766 | RP 298-5-1-11 | IR 8 x AC 1809 | 5547 |
| 3277 | MR 118 | T(N) 1 x B 370 | 4922 |
| 3281 | CR 136-76 | CR 115 x Manoharsali | 5234 |
| 3284 | CR 113-32 M | -- | 5078 |
| 3296 | IR 1561-216-6-2 | (IR 8 x Tadukan) x TKM 6$^2$x T(N)1 | 5234 |
| 3298 | IR 1561-243-5-6 | -do- | 4922 |
| 3626 | TNAU 13613 | TKM 6 Mutant | 4844 |
| 3630 | TNAU 13615 | Co 13 Mutant | 4844 |
| 4097 | DR 92 | | 5158 |
| Ratna | | | 4219 |
| CD (0.05) | | | 958 |

The number of entries tested during the second crop season included the following:

| | | | |
|---|---|---|---|
| IET 2671 | IET 2765 | IET 3621 | IET 4098 |
| ,, 2673 | ,, 2766 | ,, 3622 | ,, 4099 |
| ,, 2681 | ,, 3138 | ,, 3626 | ,, 4101 |
| ,, 2687 | ,, 3195 | ,, 3627 | ,, 4102 |
| ,, 2709 | ,, 3273 | ,, 3629 | ,, 4103 |
| ,, 2706 | ,, 3279 | ,, 3630 | ,, 4104 |
| ,, 2742 | ,, 3296 | ,, 3631 | ,, 4105 |
| ,, 2762 | ,, 3298 | ,, 4089 | ,, 4108 |
| ,, 2764 | ,, 3617 | ,, 4092 | Ratna |

Twenty entries produced higher yields over Ratna, with IET 2706 topping the list. The local choice, Jyothi (IET 2700) ranked 5th in yield potential. It, however, showed the highest production potential when the yields of 22 locations in India were taken together. The results are presented in Table 3.18.

Table 3.18. Grain yield recorded by elite entries in PVT 1; second crop 1975-76

| IET No. | Designation | Flowering duration (days) | Grain yield (kg/ha) |
|---|---|---|---|
| 2673 | C 17258 | 92 | 3704 |
| 2700 | Jyothi | 90 | 3752 |
| 2706 | MTU 5116 | 85 | 4233 |
| 3195 | PAU 125-149-2 | 88 | 3704 |
| 3296 | IR 1561-216-6-2 | 92 | 3704 |
| 3298 | IR 1561-243-5-6 | 92 | 2914 |
| 3621 | TNAU 2686-1 | 85 | 4089 |
| 3630 | TNAU 7893 | 84 | 3704 |
| 3631 | TNAU 658 | 85 | 3698 |
| 4098 | CSC 1 | 84 | 3698 |
| Ratna | | 89 | 3127 |
| C.D.(0.05) | | | 1261 |

Ac.1.1.5.16.

Preliminary variety trial 2

One hundred and eighteen mid duration varieties nominated from the national breeding nursery (NBN) were yield tested in PVT 2 during the year using Jaya as check variety. The composition of PVT 2 is given in Table 3.19.

During the first crop season when the performance of 63 entries was studied, fifteen varieties including Jaya showed yield potentials of above 6 tonnes per hectare. None of these selections, however, were significantly superior to Jaya. The highest yielder was IET 2991 with a mean grain yield of 7227 kg per ha.

Table B.19. Grain yield of elite selections in the preliminary variety trial 2; first crop season, 1975-76.

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 2729 | 6473 | | 6055 |
| 2730 | 6475 | | 6055 |
| 2717 | C 21578 | GEB 24 x IR 8 | 6055 |
| 2940 | RP 502-36 | Jaya x (IR 8 x Latisail/2) | 6152 |
| 2991 | CR 14-140-2-1051 | TKM 6 x IR 8 | 7227 |
| 2993 | CR 118-5 | (Rikku-132 x N 22) x SR 26B | 7031 |
| 3004 | CR 129-65 | IR 8/2 x LZN | 6152 |
| 3036 | MTU 3626 | IR 8 x MTU 3 | 6641 |
| 3305 | 36 33-2 | | 6836 |
| 3377 | C 14606 | | 6250 |
| 3623 | TNAU 2377 | Dawn x IR 22 | 6055 |
| 3624 | TNAU 5/3 | T(N)1 x Ptb.15 | 6836 |
| 4164 | PAU 33-3-18 | Jhona 349 x IR 127 | 6152 |
| 4165 | PAU 34-93-2 | IR 8 x Jhona 349 | 6348 |
| Jaya | | | 6348 |
| CD (0.05) | | | 975 |

Breeding for pest resistance

The ecological conditions under which rice is grown are conducive for the proliferation of insects and pathogens. The present-day high yielding rices are particularly susceptible to pests and diseases. Breeding of resistant varieties, therefore, is an agricultural need.

A large number of crosses involving resistant lines were made during the year and 3768 progenies selected after rigorous screening. These selections will be put to further tests during the next year (Table B.21).

Table B.20. Yield potentials of important selections in PVT 2; second crop, 1975-76.

| IET No. | Designation | Cross | Grain yield (kg/ha) |
|---|---|---|---|
| 1788 | RP 31-17-2 | IR 8 x Sigadis | 8477 |
| 2730 | Cul.6475 | IR 8/2 x Annapoorna | 8395 |
| 2747 | C.24578 | 6 EB 24 x IR 8 | 8560 |
| 2940 | RP 502-36 | Jaya x (IR 8 x Latisail/2) | 8724 |
| 3004 | CR 129-65 | IR 8/2 x LZN | 8066 |
| 3036 | MTU 3626 | IR 8 x MTU 3 | 9136 |
| 3057 | CR 129-3 | IR 8/2 x LZN | 8724 |
| 3060 | CR 129-20 | ,, | 8560 |
| 3076 | RP 189-4 | D6 [illegible] 6/2 x T 141 | 9959 |
| 3141 | PAU 103-61-1-1 | IR 8 x (IR 127 x IR 84) | 8313 |
| 3146 | RP 123-2-4-2-1 | IR 20 x TKM 6 | 8148 |
| 3199 | PAU 103-3-18-3-3-2 | IR 8 x (IR 127 x IR 84) | 8724 |
| 3619 | Pusa 17-395-2 | IR 127 x Bas. 370 | 8395 |
| 4082 | CR 136-1040 | Jaya x TKM 6 | 8642 |
| 4161 | PAU 21-84-2 | Dundan 13 x T(N)1 | 9053 |
| 4164 | PAU 33-3-18 | J 349 x IR 127-10-1-10 | 8642 |
| 4165 | PAU 34-93-2 | IR 8 x J 349 | 9136 |
| Jaya | | -- | 9383 |
| CL (0.05) | | | 1558 |

Table B.21. Single plants selected during 1975-76 after initial screening

| Sl.No. | Parentage | No.of single plants selected |
|---|---|---|
| 1. | Thriveni/IR 1857-78-1-3 | 61 |
| 2. | Jyothi/IR 1857-78-1-3 | 478 |
| 3. | Thriveni/IR 2071-251-1-1-3 | 483 |
| 4. | Annapoorna/IR 26 | 30 |
| 5. | Jyothi/Annapoorna | 280 |
| 6. | Bharathi/IR 1702-74-3 | 141 |

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3.21.contd...

| | | |
|---|---|---|
| 7. | Thriveni/IR 1702-74-3 | 165 |
| 8. | Jyothi/IR 2153-379-2-3-5 | 254 |
| 9. | IR 1702-/CH.5 | 224 |
| 10. | Jyothi/IR 24 | 160 |
| 11. | Thriveni/IR 1702-79-3-1-2 | 28 |
| 12. | IR 1702-74-3/Annapoorna | 27 |
| 13. | IR 1702-74-3/Jyothi | 33 |
| 14. | Jaya/IR 1820-210-2 | 137 |
| 15. | Thriveni/Jyothi | 15 |
| 16. | Jyothi/IR 26 | 25 |
| 17. | Jyothi/IR 2035-290-2-1-1 | 62 |
| 18. | Cul.12814/Si 26 | 110 |
| 19. | Jyothi/IR 2071-176-1-2-1 | 105 |
| 20. | Bharathi/IR 2 7544 | 179 |
| 21. | Jaya/IR 2063-65-2-2 | 36 |
| 22. | Jaya/IR 1632-93-2-2 | 36 |
| 23. | IR 1702-74-3//Annapoorna/Chennellu | 9 |
| 24. | Jaya/IR 2071-179-9-5 | 24 |
| 25. | Jaya/IR 2153-118-1-3-2 | 38 |
| 26. | Jaya/IR 2153-26-3-5-6 | 102 |
| 27. | Bharathi/IR 2071-25-1-1-3 | 180 |
| 28. | Jaya/IR 2061-181-16 | 115 |
| 29. | Jaya/IR 4 | 77 |
| 30. | Jaya/IR 2071-251-1-13 | 39 |
| 31. | Selections of Cul.12814 | 24 |
| | | 3768 |

The following fresh crosses were also made during the year. The parents involved in these crosses carry resistance to pests and diseases in addition to high yield potential.

1. Jaya//Jyothi/IR 26.
2. Bharathi/IR 2071//Jaya/IR 1820
3. Jaya/Thriveni/IR 2071.
4. Thriveni/IR 2071//Bharathi/IR 2071.
5. Jaya/Si 56
6. Jaya/IR 1632//Jaya.
7. Jaya/IR 4//Jaya.
8. Jaya/IR 2058//Jaya/IR 2053.
9. Jaya/IR 2058//Jaya/IR 2071.
10. Jaya/IR 2153//Bhavani.
11. Jaya/IR 2058//Mashoori.
12. Bharathi/IR 2797//Thriveni/IR 1702.
13. Bharathi/IR 1702//Jaya/IR 2153.
14. Bharathi/IR 1702//IR 1702/12814.
15. Jaya/IR 2071/Bharathi/IR 2071.
16. Jaya//T(N)1/Ptb.15.
17. Thriveni/IR 2071/Bharathi/IR 2071.
18. Jyothi/IR 1857//Thriveni/IR 2071.
19. Bharathi/IR 2071//12814/IR 26.
20. Jaya/Bharathi/IR 2797
21. 12814/IR 26//Jaya/IR 1820.
22. Bharathi/IR 2797//Jaya/IR 1632.
23. Jaya/IR 2153//23178.
24. Jaya/IR 2071//Mashoori.
25. Jaya/IR 2058//Mashoori.
26. Jaya/IR 2153//Mashoori.
27. Jaya/IR 2153//Jaya/IR 2071.
28. Jaya/IR 2058/IR 8/1025.

## BPH-GSV COMPLEX

The brown plant hopper is the most serious of all pests affecting rice in Kerala. Almost all the varieties are highly susceptible to this pest. It also acts as carrier of grassy stunt virus. In order to identify varieties resistant to this pest,. a project was initiated in 1975-76 with the generous financial assistance of the Ford Foundation.

During the year, all the available breeding materials in different generations were screened under field conditions at Mannuthy, Pattambi and Moncompu, the endemic areas for brown planthopper incidence. The intensity of incidence of the pest did not touch the threshold level to cause heavy crop damage at Mannuthy and therefore, precise assessement on pest tolerance could not be made at this centre. Based on the field tests at Moncompu and Pattambi, 400 selections were promoted for further screening during the next year. The parentages of the lines selected are given below:

| | Parentage | Nos.selected |
|---|---|---|
| 1. | Bharathi x IR 2071-625-3-1 | 103 |
| 2. | Thriveni x IR 2061- 464 | 75 |
| 3. | Thriveni x Mudgo | 96 |
| 4. | Thriveni x IR 1539 | 126 |

In addition, the following crosses were made between outstanding varieties and BPH resistant donors during the year.

1. Ptb.33//(Anna/LMN)
2. Ptb.33/Jyothi.
3. Thriveni/Ptb.33.
4. IR 5/Ptb.33.
5. Jaya/Ptb.33.
6. IR 1561/Ptb.33.
7. (Anna/LMN)//Ptb.33.
8. Bharathi/Ptb.33.
9. IR 5/Bharathi.
10. 208/Thriveni.
11. (Anna/LMN)/Thriveni.
12. Jaya/Ptb.18.
13. Jaya/Ptb.21.
14. Jaya/IR 1561-227-3.
15. Jaya/147
16. Jaya/IR 2071-625
17. IR 2071-625/Ptb.15.
18. IR 2071-625/Ptb.21.
19. IR 1561-228-3/Ptb.21.
20. IR 1561-228-3//Orpandy.
21. 76/Jaya.
22. 165/Jaya.
23. 203/Jaya.
24. 227/Jaya.
25. 253/Jaya.
26. 298/Jaya.
27. 243/Thriveni.
28. Anna/LMN/253
29. 227/Thriveni.
30. IR 32/Ptb.33. contd....

31. IR 26/Ptb.33.
32. 234/IR 26.
33. Jyothi/245
34. 7960/Ptb.33
35. 703/Ptb.33.
36. 6-9-9/Ptb.33.
37. 12814/Ptb.33.
38. 10-1-1/Ptb.33.
39. ARC 6650/Jaya.
40. Ptb.33/IET 1444
41. Jaya/H4
42. Bharathi/24663
43. 24663/Bharathi
44. 24684/Jyothi.
45. 24663/*O. perrennis*.
46. Aswathy/Jyothi
47. Pankaj/24678
48. 24684/Rohini.
49. Jayanthi/H4
50. H4/Jyothi.
51. H4/Jaya.
52. H 105/Jaya.
53. 24663/IR 5.
54. Blue Bonnet/Malinja.
55. Jaya/24659-6.

The first generation hybrids will be raised during 1976-77.

# A G R O N O M Y

Ag.1.1.1.1.

## Moderate nitrogen technology

Nitrogen is a costly input. Therefore marginal farmers cannot afford to apply larger doses to rice crop. Moreover, nitrogen use efficiency is low in lowland rice fields. Can efficiency of applied nitrogen be increased by modifying the time and rate of application? The study is aimed at answering this question.

The experiment was initiated in 1974-75 and was continued in 1975-76. The test variety was Aswathi, a mid duration dwarf *indica* rice. Nitrogen was applied at 100%, 75% and 50% of the present recommended dose of 90 kg/ha for medium duration rices in three fractions during the different growth stages of rice as detailed under Table A.1. Phosphorus and potash were applied as basal dressing at 45 kg each per ha in all the plots except in treatment 8. Altogether there were 8 treatments with each treatment replicated 4 times in a randomised block design.

Table A.1. Grain yield corresponding to different treatments in the moderate nitrogen technology experiment

| Tr. No. | Percentage of nitrogen applied: Planting | Initial tillering (10 DAT) | Mid tillering (30 DAT) | Panicle initiation | Total | Grain yield (kg/ha): First crop | Second crop |
|---|---|---|---|---|---|---|---|
| 1. | 50.0 | -- | 25.00 | 25.00 | 100 | 3599 | 2404 |
| 2. | -- | 50.0 | 25.00 | 25.00 | 100 | 3869 | 2271 |
| 3. | 37.5 | -- | 18.75 | 18.75 | 75 | 3701 | 2349 |
| 4. | -- | 37.5 | 18.75 | 18.75 | 75 | 3743 | 2377 |
| 5. | 25.0 | -- | 12.50 | 12.50 | 50 | 3743 | 2271 |
| 6. | -- | 25.0 | 12.50 | 12.50 | 50 | 3548 | 2053 |
| 7. | P2O5 and K2O only | | | | | 2963 | 2104 |
| 8. | No manure | | | | | 3002 | 1792 |
| | CD (0.05) | | | | | 335 | 371 |

DAT = Days after transplanting.

No marked yield variation was observed due to rates of nitrogen application (100, 75, 50% of 90 kg N/ha) showing thereby that the present recommended dose can be reduced to 50 percent under adequate crop management including time of application of nitrogen (Table A.1.). Relatively more yields were obtained under all the 3 rates of nitrogen when the basal dose of nitrogen was postponed to initial tillering phase of the crop (15 DAT) during the rainy season. Nitrogen top-dressing at initial tillering favoured the production of larger number of panicles per hill and this contributed to higher grain yield.

Ag.1.1.1.2.

Phosphate and potash manuring of rice

This investigation was initiated in 1974-75 in order to find out whether application of phosphorus and potash could be skipped over for one or more seasons without affecting yield as an economy measure under resource constraints. The treatment details are presented in Table A.2. All the treatments were supplied with a uniform dose of 70 kg N/ha in 2 instalments at planting and panicle initiation stages. The levels of $P_2O_5$ and $K_2O$ were 35 kg each per ha. Both these nutrients were applied at planting according to treatment schedule. The test variety was Thriveni, an early duration rice.

The design of the experiment was randomised block with 4 replications.

As in the previous 2 seasons, treatment differences were not statistically significant on panicles/hill as well as grain yield (Table A.2.). However, there has been a definite decline in yield in the plots receiving neither phosphorus nor potash continuously during the last 4 seasons. The reduction in yield on account of continuous application of nitrogen alone (Treatment 10; without $P_2O_5$ and $K_2O$) was 420 kg/ha on an average of 2 seasons in 1975-76 compared to treatment 1 receiving N, P and K regularly.

Table A.2. Response of Thriveni rice to nitrogen, phosphorus and potash.

| Tr. No. | Treatment 1974-75 First crop | Treatment 1974-75 Second crop | Treatment 1975-76 First crop | Treatment 1975-76 Second crop | Grain yield (kg/ha) 1975-76 First crop | Grain yield (kg/ha) 1975-76 Second crop |
|---|---|---|---|---|---|---|
| 1. | N P K | N P K | N P K | N P K | 3538 | 2581 |
| 2. | N P K | N - K | N P K | N - K | 3758 | 2271 |
| 3. | N - K | N P K | N - K | N P K | 3605 | 2337 |
| 4. | N P K | N - K | N - K | N P K | 3406 | 2138 |
| 5. | N - K | N P K | N - K | N - K | 3638 | 2337 |
| 6. | N P K | N P - | N P K | N P - | 3635 | 2219 |
| 7. | N P - | N P K | N P - | N P K | 3781 | 2083 |
| 8. | N P K | N P - | N P - | N P K | 3627 | 2194 |
| 9. | N P - | N P K | N P - | N P - | 3619 | 2315 |
| 10. | N - - | N - - | N - - | N - - | 3263 | 2017 |
| | F (0.05) | | | | N.S. | N.S. |

-, skipping over application of P or K according to position.

These results show that phosphorus and potash can be skipped over for one or 2 seasons without significant yield reduction in the rice soils of Pattambi. The status of available phosphorus and potash in these soils is adequate enough to support plant growth and production for one or two seasons.

Ag.1.1.1.3.

Production potential of early duration rices

The production potential of 3 very early duration rices evolved by hybridization and selection at the Agricultural College and Research Institute, Vellayani was evaluated in this experiment. The treatments comprised of 5 varieties (C 47-41, C 28-26, C 24-20, Annapoorna and Rohini) and 2 levels of nitrogen (75, 90 kg/ha). The design of the experiment was randomised block with 4 replications.

Half the dose of nitrogen was applied at planting alongwith phosphorus and potash at the rate of 40 kg each per ha. The rest of the nitrogen was top dressed at panicle initiation.

The experiment was conducted during the second crop season of 1975-76.

The cultures C 28-26 and C 24-20 were the earliest among the varieties tested. They recorded a total duration of 83 days from seed to seed. The culture C 47-41 was on par with Annapoorna in duration (Table A.3.). Rohini and Annapoorna, the local checks, were far superior to the early duration pre-release cultures, recording respectively, 3526 kg

Table A.3. Yield potential of early duration rices

| Variety | Total duration (days) | Grain yield (kg/ha) at 75 kg N/ha | Grain yield (kg/ha) at 90 kg N/ha | Mean | Productivity (kg/ha/day) |
|---|---|---|---|---|---|
| 1. Rohini | 98 | 3538 | 3513 | 3526 | 36.0 |
| 2. Annapoorna | 91 | 3571 | 3679 | 3625 | 39.8 |
| 3. Culture 47-41 | 91 | 2625 | 2791 | 2708 | 29.8 |
| 4. Culture 28-26 | 83 | 2350 | 2267 | 2309 | 27.8 |
| 5. Culture 24-20 | 83 | 2575 | 2517 | 2546 | 30.7 |
| CD (0.05) | | | | 382 | |

and 3625 kg of grain per ha. In terms of productivity per day also these varieties were significantly superior to the Vellayani cultures. The culture, 47-41, however, showed promise.

None of the test varieties responded to the higher dose of nitrogen (90 kg/ha).

Ag.1.1.1.4.

## Sagar, a new fertilizer material

'Sagar' is claimed to be an excellent fertilizer supplement for field crops. It contains, in addition to nitrogen and potash, secondary and trace elements. Effect of sagar on the yield and yield attributes of rice was investigated in this experiment.

Sagar was tried at 200 kg/ha singly and in combination with the full and half the present recommended doses of nitrogen, phosphorus and potash for medium duration rices (90:45:45 kg/ha) (Table A.4). The test variety was Jaya.

Table A.4. Response of Jaya rice to 'sagar'.

| Treatments | Productive tillers/ha | | Grain yield (kg/ha) | |
|---|---|---|---|---|
| | First crop | Second crop | First crop | Second crop |
| 1. No manure (control) | 4.5 | 4.9 | 4226 | 2555 |
| 2. Sagar at 200 kg/ha | 4.7 | 4.8 | 4309 | 2647 |
| 3. Sagar at 0 kg/ha + 45 kg N, 22.5 kg $P_2O_5$ & 22.5 kg $K_2O$/ha | 5.3 | 5.7 | 4688 | 3291 |
| 4. Sagar at 200 kg/ha + 45 kg N, 22.5 kg $P_2O_5$ and 22.5 kg $K_2O$/ha | 5.7 | 5.9 | 4780 | 3201 |
| 5. Sagar at 0 kg/ha + 90 kg N, 45 kg $P_2O_5$ and 45 kg $K_2O$/ha | 6.0 | 5.9 | 5171 | 3324 |
| 6. Sagar at 200 kg/ha + 90 kg N, 45 kg $P_2O_5$ &45 kg $K_2O$/ha | 5.2 | 6.0 | 4971 | 3201 |
| CD (0.05) | | | 380 | 335 |

Sagar by itself produced no significant yield increase (Table A.4.) during both the seasons of 1975-76. It also failed to exhibit any positive effect on growth and production as a fertilizer supplement. Similar results were recorded during 1974-75 also when the trial was initiated.

Ag.1.1.1.5.
Seedling-root-dip in phosphate slurry

This experiment was initiated in the second crop season of the current year with the objective of understanding the relative merits of soil application of phosphorus and seedling-root-dip in phosphate-soil-slurry. Response of transplanted rice to phosphorus was studied using graded doses of phosphorus in the form of superphosphate (Table A.5.). The test variety was Aswathi.

Table A.5. Response of rice to phosphate application; second crop, 1975-76.

| Treatment | Productive tiller/hill | Grain yield (kg/ha) |
|---|---|---|
| 1. Control (no P) | 6.6 | 3785 |
| 2. Soil application of 30 kg $P_2O_5$/ha | 6.8 | 3189 |
| 3. Soil application of 45 ,, | 6.3 | 2821 |
| 4. -do- 60 ,, | 6.7 | 3061 |
| 5. Seedling-root-dip in phosphate soils lurry at 8 kg $P_2O_5$/ha (50 kg superphosphate, 150 kg soil, 500 litres water) | 6.7 | 3289 |
| 6. Seedling root dip in phosphate-soil-slurry at 16 kg $P_2O_5$/ha (100 kg superphosphate, 400 kg soil, 500 l. water) | 6.5 | 3048 |
| 7. Seedling root dip in phosphate-soil-slurry at 24 kg $P_2O_5$/ha (150 kg superphosphate, 350 kg soil, 500 lit.water) | 6.1 | 2877 |
| 8. Seedling-root-dip in phosphate-soil-slurry at 32 kg $P_2O_5$/ha (200 kg superphosphate, 300 kg soil, 500 lit.water) | 6.7 | 3487 |
| F (0.05) | | N.S. |

All treatments received N at 90 kg/ha and $K_2O$ at 45 kg/ha.

The test variety exhibited no marked response to applied phosphorus. In fact, higher yields were harvested from the plots receiving no phosphorus (Table A.5). This indicates that there is a critical level of phosphorus in the soil beyond which addition of phosphate will only depress grain production. Similar results have been recorded in other trials also on phosphate manuring.

Ag.1.1.1.7.

Newer fertilizer materials

An unreplicated observational trial was conducted during the year in order to identify effective fertilizer materials for lowland rice. The treatment details are described in Table A.6.

Table A.6. Grain yield of 'Jaya' rice corresponding to different treatments in the observational trial.

| Treatment | Grain yield (kg/ha) First crop | Grain yield (kg/ha) Second crop |
|---|---|---|
| 1. Control N; 90 kg/ha; $P_2O_5$ and $K_2O$: 45 kg each/ha | 1888 | 2762 |
| 2. Treatment 1 + lime at 250 kg/ha | 4888 | 3195 |
| 3. Treatment 1 + 'Geolime' at 250 kg/ha | 1515 | 2862 |
| 4. Treatment 1 + 'Sanjeevani' at 250 kg/ha | 1737 | 3195 |
| 5. Treatment 1 + 'Nu-spartin' spray at 2 kg/ha at 20 DAT and 35 DAT | 4132 | 2519 |
| 6. Treatment 1 + 'Bahar' spray at 2 kg/ha at 20 DAT and 35 DAT | 4687 | 2549 |
| 7. Nitrogen at 90 kg/ha; $K_2O$ at 45 kg/ha and $P_2O_5$ as slurry at 22.5 kg/ha (root dip) (First crop only) | 1929 | -- |
| 8. 'Algo (algo power applied on soil surface at 70 g/100 $m^2$) | 4163 | 2318 |
| 9. N at 45 kg/ha dissolved in water, churned for 2 minutes and applied on soil surface ($P_2O_5$ and $K_2O$ : 45 kg each/ha) | 4838 | 2318 |
| 10. Treatment 1 + 'multiplex' spray at 2 kg/ha at 20 DAT and 35 DAT (second crop only) | - | 3028 |

None of the new materials produced marked yield increase over the control (the present recommended dose of N, P, K). Therefore, no valid inference can be drawn from this trial.

The grain yield data are presented in Table A.6.

Ag.1.1.1.19

<u>Effect of bacterial fertilizer and supercompost</u>

Azotobacter is considered to be a source of natural nitrogen enrichment for rice soils. This organism thrives on soil surface and fixes atmospheric nitrogen. Effect of a commercial preparation of azotobacter (azo) on the growth and yield of lowland rice was investigated during 1975-76.

Table A.7. Grain yield corresponding to different treatments in 'Azo-supercompost' experiment

| Treatment | Grain yield (kg/ha) First crop | Grain yield (kg/ha) Second crop |
|---|---|---|
| 1. Control (no nitrogen) | 2796 | 2228 |
| 2. Nitrogen at 90 kg/ha | 4157 | 2891 |
| 3. -do- 45 ,, | 3590 | 2891 |
| 4. -do- 30 ,, | 3119 | 2874 |
| 5. -do- 45 ,, + Azo | 3491 | 2891 |
| 6. -do- 30 + Azo | 3080 | 2664 |
| 7. Azo alone | 2702 | 2311 |
| 8. Azo + Amm.molybdate at 1 kg/ha | 2872 | 2023 |
| 9. Azo + lime at 250 kg/ha | 3042 | 2398 |
| 10. Azo + Amm.molybdate at 1 kg/ha + lime at 250 kg/ha | 2929 | 2137 |
| 11. 90 kg N/ha + supercompost at 5 t/ha | [illegible]762 | 3328 |
| 12. Supercompost at 5 t/ha + Azo | 2664 | 2285 |
| C.D(0.05) | N.S. | N.S. |

The treatments included 3 doses of nitrogen (100%, 50% and 33% of the present recommended dose for mid duration rices), 'azo', lime, molybdenum and supercompost in different combinations as detailed in Table A.7. Each treatment had 4 replications in a randomised complete block design. The variety planted was Jaya. 'Azo' was applied by broadcast at 2.5 kg/ha just before transplanting in addition to seed treatment in the nursery at the rate of 20 kg per kg of seed. All the treatments except 11 and 12 received a basal dose of 45 kg $P_2O_5$ per ha. Potash was applied uniformly in all the plots at the rate of 45 kg/ha at planting.

'Azo', by itself produced no marked effect on crop growth and production. Addition of lime, molybdenum or supercompost or a combination of all these supplements did not improve its efficiency. 'Azo' thus proved to be ineffective under swampy condition (Table A.7). Significantly higher yields were obtained when nitrogen was applied in combination with supercompost (treatment 11). This treatment yielded, on an average of 2 seasons,521 kg/ha more grain than treatment 2 which received an equal amount of nitrogen but no supercompost. Supercompost thus proved to be beneficial for rice.

Ag.1.1.1.29.

Response of rice to micronutrients

Feeler trials on micronutrients were conducted in cultivators' fields at Kumbidi, Mannarghat and Coyalmannam in 1972-73. These trials indicated moderate response to applied copper and molybdenum. Based on these results, an investigation was initiated in 1974-75 to study the response of transplanted lowland rice to zinc, copper, molybdenum and magnesium (Table A.8). The design of the experiment was randomised block replicated 4 times.

All the treatments received a uniform dose of nitrogen, phosphorus and potash, respectively, at 90, 45, 45 kg/ha. The micronutrients were applied at the early tillering phase of the crop. The test variety was Aswathi.

As in the previous year, the treatment differences did not touch the level of statistical significance during both the seasons (Table A.8). The crop in the control plots also did not show symptoms of micronutrient deficiency at any phase of growth. Regular application of organic manures in the rice fields might be one of the reasons for the lack of response to micrcelements in the Pattambi rice soils.

Table A.8. Response of Aswathi rice to microelements and magnesium

| Treatment | Form of nutrient | Rate of application (kg/ha) | Panicles/hill | | Grain yield (kg/ha) | |
|---|---|---|---|---|---|---|
| | | | First crop | Second crop | First crop | Second crop |
| 1. Control | | | 4.9 | 5.5 | 3834 | 2861 |
| 2. Zinc | Zinc sulphate | 15 | 5.6 | 5.1 | 3747 | 2702 |
| 3. Zinc | ,, | 30 | 5.3 | 5.5 | 3922 | 3081 |
| 4. Copper | Copper sulphate | 25 | 6.0 | 5.6 | 3791 | 3095 |
| 5. Copper | ,, | 50 | 5.5 | 5.6 | 3573 | 2847 |
| 6. Magnesium | Magnesium sulphate | 100 | 5.5 | 6.1 | 3747 | 2803 |
| 7. Magnesium | ,, | 200 | 5.1 | 6.1 | 3747 | 3064 |
| 8. Molybdenum | Ammonium molybdate | 1 | 5.2 | 5.2 | 3181 | 2998 |
| 9. Molybdenum | ,, | 2 | 4.9 | 4.8 | 3791 | 2963 |
| 10. Farm year manure (control) | | 5000 | 5.5 | 5.8 | 3834 | 2948 |
| C.D. (0.05) | | | | | N.S. | NS. |

Ag.1.1.1.31.

Oil cakes as nitrification inhibitors

The relative efficacy of some of the indigenous oil cakes in their capacity to increase the efficiency of applied nitrogen was studied in this experiment. There were 6 treatments replicated 4 times in a randomised block design (Table A.9.). The level of nitrogen was 90 kg per ha in the form of urea. Twenty-four hours before application, urea was blended with powdered cakes at the rate of 20 percent by weight of the fertilizer. Phosphorus and potash were applied at 45 kg each per hectare as basal dressing. The test variety was Bharathi.

Table A.9. Mean number of productive tillers per hill and grain yield as influenced by oil cakes.

| Treatment | Productive tillers per hill | | Grain yield (kg/ha) | |
|---|---|---|---|---|
| | First frop | Second crop | First crop | Second crop |
| 1. Urea (untreated) | 5.6 | 5.9 | 3572 | 2202 |
| 2. Urea treated with neem cake | 6.0 | 6.6 | 3492 | 2214 |
| 3. Urea treated with marotti cake | 5.3 | 6.7 | 3452 | 2262 |
| 4. Urea treated with punna cake | 5.5 | 6.9 | 3532 | 2421 |
| 5. Urea treated with karimkotta cake | 5.1 | 6.5 | 3611 | 2254 |
| 6. Urea treated with rubber cake | 5.1 | 5.4 | 3611 | 2333 |
| C.D(0.05) | | | N.S. | N.S. |

The data on productive tillers/hill and grain yield showed no significant difference between treatments during both the seasons (Table A.9). The trend of the results, however, indicated that rubber cake, karimkotta cake and punna cake/were slightly superior to neem cake in increasing efficiency of applied urea.

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Ag. ICAR 1.1.1.8.

### Yield potential of early duration rices

Five pre-release early duration rice cultures were evaluated under four levels of nitrogen during the second crop season of 1975-76 in order to identify nitrogen responsive varieties for large scale adoption. The pre-release cultures were IET 1444, IET 2233, IET 2508, IET 3262 and IET 2881. Ratna, Jyothi and Thriveni were used as check varieties.

The trial was laid out in split plot design with varieties in the whole plots and nitrogen levels (0, 40, 80, 120 kg/ha) in the sub plots. There were 3 replications. Nitrogen was applied in 3 splits in the proportion 2:1:1 at planting, tillering and panicle initiation stages. All the treatments received 80 kg $P_2O_5$ and 50 kg $K_2O$ per ha uniformly as basal dressing.

Table A.10. Grain yield corresponding to different varieties and nitrogen levels in the nitrogen-variety trial.

| Variety/Culture | Total duration (days) | Grain yield (kg/ha) | Productivity/ha/day (kg) | Nitrogen (kg/ha) | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| IET 1444 | 102 | 2763 | 27.1 | 0 | 1662 |
| 2233 | 97 | 1439 | 14.7 | 40 | 2072 |
| 2508 | 98 | 2015 | 20.9 | 80 | 2197 |
| 3262 | 110 | 1710 | 15.5 | 120 | 2127 |
| 2881 | 103 | 1191 | 14.4 | | |
| Ratna | 99 | 1991 | 19.2 | | |
| Jyothi | 109 | 2592 | 23.8 | | |
| Thriveni | 100 | 2004 | 20.0 | | |
| CD(0.05) | | 527 | | | 192 |

Response to applied nitrogen was generally low owing to the moisture stress conditions that prevailed during the season. On an average of all the varieties tested, response was 10.25 kg of grain per kg of nitrogen at the 40 kg/ha level and 5.56 kg of grain per kg of nitrogen at the 80 kg/ha level. None of the varieties responded to nitrogen significantly beyond 40 kg/ha.

The pre-release culture IET 1444 (Taichung (N)1 x Co 29) and the local choice, Jyothi recorded significantly higher yields over the rest of the varieties with the former registering an increased yield of 171 kg/ha over the latter which yielded 2592 kg/ha. In terms of productivity per day also these 2 varieties were superior to the others tested (Table A.10).

Ag. ICAR 1.1.1.10.
<u>Nitrogen management for early duration rice</u>

The objective of this experiment was to study the response of transplanted early duration rice varieties to nitrogen as affected by rate and time of application and plant population density.

The treatments comprised of 2 spacings (15 cm x 10 cm; 15 cm x 20 cm), 2 levels of nitrogen (0, 60 kg/ha) and 3 stages of application. Altogether, there were 10 treatments as detailed in Table A.11. The design of the experiment was randomised block with 4 replications. The test variety was Thriveni.

Application of 60 kg N/ha in one dose at planting resulted in a mean grain yield of 2777 kg/ha which was equivalent to a nitrogen response of hardly 6 kg of grain per kg of nitrogen. Response to nitrogen increased significantly when it was applied in 2 equal splits at tillering and panicle initiation stages as in treatment 5, the production of grain per kg of nitrogen being 14.2 kg. Fractional application of nitrogen at planting and panicle initiation stages as in treatment 3 also produced equally good results. It yielded 12 kg of grain per kg of applied nitrogen. The results indicate that split application of nitrogen during the appropriate growth stages is more effective than application of nitrogen entirely at planting.

Table A.11. Grain yield (kg/ha) of 'Thriveni' rice as influenced by plant density and time of application of nitrogen.

| No. | Nitrogen application at (kg/ha) | | | Spacing (cm) | | Mean | C.D. (0.05) |
|---|---|---|---|---|---|---|---|
| | planting | tillering | P.I. | 15x10 | 15 x 20 | | |
| 1. | -- | -- | -- | 2310 | 2556 | 2433 | |
| 2. | 60 | -- | -- | 2781 | 2773 | 2777 | |
| 3. | 40 | -- | 20 | 3113 | 3193 | 3153 | 287 |
| 4. | 30 | 15 | 15 | 3017 | 3013 | 3014 | |
| 5. | -- | 30 | 30 | 3179 | 3393 | 3286 | |
| Mean | | | | 2886 | 2991 | | |
| C.D. (0.05) | | | | N.S. | | | |

Density of planting exerted no marked influence on grain yield and nitrogen response. The interactional effect of nitrogen and plant density was also not significant. The results are presented in Table A.11.

Ag. ICAR 1.1.1.13.

Sources and timings of nitrogen application

Upto one half of the nitrogen applied in conventional fertilizers is lost through leaching and denitrification from waterlogged rice soils. This results in poor crop recovery. It is, therefore, essential to introduce such fertilizer practices that would increase the efficiency of applied nitrogen and these relate to placement, split application and use of slow release fertilizers. In this investigation, the relative efficacy of 2 slow release sources of nitrogen (sulphur coated urea and isobutylidene diurea) on the yield and yield attributes of transplanted rice was studied.

The trial was conducted during the first crop season with 10 treatments replicated 4 times in a randomised block design (Table A.12.). The variety tried was Rohini, an early duration dwarf indica rice.

Table A.12. Grain yield as influenced by sources and times of nitrogen application

| Tr. No. | N applied (kg/ha) at Planting | Tillering | P.I. | Grain yield (kg/ha) | Rank |
|---|---|---|---|---|---|
| 1. | -- | -- | -- | 3172 | 10 |
| 2. | 60 | -- | -- | 3815 | 6 |
| 3. | 60* | -- | -- | 4160 | 2 |
| 4. | 30* | 15 | 15 | 4023 | 3 |
| 5. | 40* | -- | 20 | 4188 | 1 |
| 6. | 60@ | -- | -- | 3913 | 4 |
| 7. | 40 | -- | 20 | 3705 | 8 |
| 8. | 40 | -- | 20F | 3760 | 7 |
| 9. | 30 | 15 | 15 | 3666 | 9 |
| 10. | -- | 30 | 30 | 3885 | 5 |
| CD (0.05) | | | | 121 | |

P.I. Panicle initiation; *, SCU; @, IBDU.

The slow release sources of nitrogen ie.SCU(Sulphur coated urea) and IBDU(Isobutylidene diburea) were observed to be significantly superior to ordinary urea when applied entirely at planting. Sulphur coated urea recorded a mean response of 16.5 kg of grain per kg of nitrogen while ordinary urea yielded only 10.7 kg of grain per kg of nitrogen.

Response of IBDU to applied nitrogen was 12.3 kg of grain per kg of nitrogen.

The maximum yield of grain was recorded by the treatment (Tr.5) receiving 40 kg N/ha as SCU at planting and 20 kg N/ha as top dressing at the panicle initiation stage. There was, however, no significant difference among treatments 5, 3 and 1. All these treatments received SUC in various proportions at planting.

The study indicates that we can do away with top dressing provided slow release sources of nitrogen are applied at planting.

Ag.ICAR 1.1.1.5.
<u>Chemical control of weeds in direct-sown rice</u>

Weed control by traditional methods is far more difficult and expensive in direct sown rice than in transplanted rice. Chemical control of weeds, therefore, is gaining recognition in direct sown rice. The relative efficacy of some of the new chemicals on the control of weeds in direct-seeded rice under puddled conditions was investigated in this experiment.

The experiment was laid out in randomised block design with 4 replications. The treatments comprised of 8 pre-emergent granulated herbicides in 9 combinations and an untreated control (Table A.13 ). The chemicals were applied on the 7th day after sowing.

The test variety was IR 20. The seed rate adopted was 100 kg/ha. The crop received 25 kg N, 60 kg $P_2O_5$ and 40 kg $K_2O$ per ha at sowing. Nitrogen was top dressed at the tillering and panicle initiation stages at 20 kg/ha each time.

Among the herbicides tested, USB 2548 was the most toxic to the young rice seedlings, the rate of mortality being as high as 80 percent. Mon 0385 also caused severe injury to the seedlings when it was applied in combination with 2,4-D.

In the absence of 2,4-D, it was less toxic. Benthiocarb/ 2,4-D, Butachlor + 2,4-D and C 288 were less toxic compared to the chemicals mentioned above (Table A.13).

Table A.13. Visual ratings on phytotoxicity, weed control and grain yield as influenced by herbicides.

| Treatment | Rate of appln. (kg a.i/ha) | Toxicity rating (20 DAS) | Weed control rating (30 DAS) | Weed control rating (45 DAS) | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| 1. Mon 0358 | 0.5 | 2.00 | 2.30 | 2.30 | 3368 |
| 2. Mon 0358 + 2,4-D IPE | 0.25 + 0.5 | 3.75 | 1.00 | 1.25 | 3316 |
| 3. C 288 | 0.5 | 2.00 | 1.00 | 1.25 | 3395 |
| 4. C.19490/ 2,4-D IPE | 0.75 | 3.00 | 1.25 | 1.40 | 3211 |
| 5. Destun/ 2,4-D IPE | 1.0/0.25 | 3.00 | 1.50 | 1.50 | 3395 |
| 6. USB 3584 | 0.75 | 1.30 | 3.00 | 2.90 | 2779 |
| 7. USB 3584 + 2,4-D IPE | 0.5 + 0.5 | 4.00 | 1.00 | 1.10 | 3163 |
| 8. Butachlor + 2,4-D IPE | 0.75 + 0.5 | 2.23 | 2.00 | 1.63 | 3474 |
| 9. Benthiocarb/ 2,4-D IPE | 1.0/0.5 | 2.75 | 1.50 | 1.63 | 3674 |
| 10. Unweeded control | | (1.00) | 5.00 | 5.00 | 2016 |
| C.D. (0.05) | | | | | 626 |

Weed control ratings carried out on the 30th day and the 45th day after sowing indicated that C 288, C 19490/ 2,4-D and Destun/2,4-D, Butachlor + 2,4-D and Benthiocarb/ 2,4-D were quite effective on weed control. USB 3548 and Mon 0385 did not give adequate weed control in the absence of 2,4-D.

Benthiocarb/2,4-D produced the highest yield of 3674 kg/ha, the percentage of increase in yield being 82.2 over the untreated control (Table A.13). Machete + 2,4-D ranked second in yield, recording 3474 kg/ha. In spite of being toxic to young seedling, USB 3854, when applied in combination with 2,4-D, produced equally good results as Machete + 2,4-D. Judged for the ratings on toxicity to seedlings, weed control and grain yield, it is concluded that Benthiocarb and Butachlor can be safely used in combination with 2,4-D for weed control in direct -sown rice under puddled conditions.

Ag. ICAR 1.1.1.11.

Nitrogen management for mid duration rices

Nitrogen use efficiency can be increased considerably by applying the nutrient at a time when the plant is able to make the best use of it. The optimum time of application of nitrogen under a moderate level of application for dwarf and tall rice varieties was worked out in this experiment.

The experiment was conducted during the second crop season with 2 varieties differing in plant type (Ptb.20 and Sabari, tall and dwarf, respectively) and 8 fractional applications of nitrogen. The treatments were replicated 4 times in a randomised complete block design. The test varieties were transplanted at a spacing of 15 cm x 15 cm. At planting, phosphorus and potash were applied at 45 kg each per hectare.

The treatment differences were statistically significant on grain yield.

Application of the entire dose of nitrogen (50 kg/ha) at planting resulted in a mean grain yield of 3010 kg/ha, response being 11.8 kg of grain per kg of nitrogen. The best results were, however, obtained when 50 kg N/ha was applied as topdressing 7 days before panicle initiation. Nitrogen topdressing at this stage produced an yield response of 18.7 kg of grain per kg of applied nitrogen. Fractional application of nitrogen in 2 equal instalments - 25 kg at planting and 25 kg 7 days before panicle initiation - also proved to be effective, producing 15.5 kg of grain per kg of nitrogen.

Table A.14. Grain yields of Sabari and Ptb.20 as influenced by time of application of nitrogen.

| No. | Time of application of N(kg/ha) planting | Tillering | 7 days before P.I. | P.I. | Total N (kg/ha) | Variety Sabari | Ptb. 20 | Mean |
|---|---|---|---|---|---|---|---|---|
| 1. | -- | -- | -- | -- | -- | 2121 | 2714 | 2418 |
| 2. | 50 | -- | -- | -- | 50 | 2518 | 3522 | 3010 |
| 3. | -- | 50 | -- | -- | 50 | 2889 | 3286 | 3081 |
| 4. | -- | -- | 50 | -- | 50 | 3158 | 3556 | 3354 |
| 5. | -- | 25 | 25 | -- | 50 | 3017 | 2727 | 2956 |
| 6. | -- | 25 | -- | 25 | 50 | 2653 | 3421 | 3037 |
| 7. | 25 | 25 | -- | -- | 50 | 2545 | 3320 | 2029 |
| 8. | 25 | -- | 25 | -- | 50 | 2923 | 3468 | 3192 |
| | mean | | | | | 2727 | 3253 | |
| | C.D.(0.05) | | | | | 94 | | 189 |

The local tall cultivar, Ptb.20 proved itself to be superior to the dwarf variety, Sabari, the difference in yield being 526 kg/ha. The dwarf variety succumbed to severe incidence of case worm during the initial tillering stage and this might be the reason for its poor performance. Ptb.20 was practically free of pest incidence.

The study indicates that rice requires a reasonable amount of nitrogen at the panicle initiation stage and that the best time for topdressing nitrogen is 7 days before panicle initiation.

Ag. ICAR 1.1.1.9.

Management of noncash inputs

Age of seedling is a component affecting the ultimate production in transplanted rice. The effect of age of seedling becomes more critical as the duration of the variety decreases. In this experiment, agronomic manipulations suitable for increasing the productivity of older seedlings were worked out.

The experiment was laid out in a randomised block design. There were 4 replications. The treatments were:

1. Old seedlings (36 days) - deep bunch planting (6-7 cm deep, 8-10 seedlings/hill) - no nitrogen - wide spacing (20 x 20 cm) - no weed control.
2. Treatment 1 with timely weed control.
3. Treatment 2 with 50 kg N/ha.
4. Old seedlings - deep bunch planting - close spacing - (20 x 10 cm) - 50 kg N/ha - timely weed control.
5. Old seedlings - shallow planting (2-3 cm deep) with 2 seedlings per hill - close spacing - 50 kg N/ha - timely weed control -
6. Young seedlings (21 days) - shallow planting - close spacing - 50 kg N/ha - timely weed control -

Nitrogen was applied in 2 equal instalments at planting and at panicle initiation. Phosphorus and potash were applied as basal dressing at 45 kg each per hectare in all the plots.

The test variety was Jyothi.

The effect due to treatments on grain yield was statistically significant.

The highest yield was registered by treatment 4 in which 36 days-old seedlings were planted in bunches under closer spacing. This treatment was, however, on par with treatments 5 and 3 in grain yield and number of productive tillers per unit area (Table A.15). It indicates that nitrogen plays a more important role than plant population per unit area in grain production. The yields recorded in treatments 2 and 3 illustrate this point further. Both these treatments were planted in bunches with 8-10 seedlings per hill under wider spacing. Treatment 3 received 50 kg N/ha in addition. The increase in yield recorded by treatment 3 over 2 was 1277 kg per ha ie. 25.5 kg of grain per kg of applied nitrogen.

Table A.15. Flowering duration, number of panicles per $m^2$ and grain yield as influenced by age of seedling, plant density and nitrogen.

| Treatment | Flowering duration (days) | No.of panicles per $m^2$ | Grain yield (kg/ha) | Productivity (kg/ha/day) |
|---|---|---|---|---|
| 1. | 78 | 213 | 2224 | 20.59 |
| 2. | 78 | 214 | 2209 | 20.45 |
| 3. | 79 | 316 | 3486 | 31.98 |
| 4. | 79 | 370 | 3617 | 33.18 |
| 5. | 90 | 328 | 3533 | 29.44 |
| 6. | 80 | 301 | 3269 | 29.72 |
| C.D.(0.05) | | N.S. | 269 | |

Under identical management practices, 36 day old seedlings (Tr.5) proved to be significantly superior to the 24 day old seedlings (tr.6) in yield potential. It recorded 3533 kg of grain per ha while the 24 day-old seedlings yielded only 3269 kg per ha.

Flowering duration of older seedlings was seen influenced by the number of seedlings planted per hill. The seedlings planted deep in bunches took 78-79 days to flower while those planted shallow with 2 seedlings per hill took 10 more days to flower.

..g. ICAR.1.1.1.13.
Varietal reaction to brown planthopper

High fertility conditions and thick plant population favour incidence of pests. This is particularly true of brown planthopper. Reaction of 2 rice varieties to brown planthopper as affected by fertility levels and plant population density was studied in this investigation.

The experiment was initiated during the second crop season of 1975-76 with 2 varieties (Jaya; IET 2815) and 4 factorial combinations of 2 levels each of nitrogen (150, 75 kg/ha) and spacing (10 cm x 10 cm; 20 cm x 20 cm). The varieties were tried in the whole plots and nitrogen x spacing in the subplots in a split plot design. There were 4 replications. All the plots were maintained under unprotected conditions in order to induce pest incidence.

The intensity of incidence of 2 major rice pests - stem borer and brown planthopper - was estimated during 3 stages ie. at active tillering (30 DAT), at panicle initiation (50 DAT) and at harvest. During none of the growth phases, the population of brown planthopper did increase to a threshold level and the damage due to the pest was practically negligible. (Table A.16). Natural enemies like spiders, mites, etc. were found in plenty in all the plots. This might be one of the reasons why the population of brown planthopper did not increase to the expected level. The rate of incidence of stem borer at the vegetative phase (dead hearts) ranged from 9% to 15% in Jaya and 10.5% to 12.1% in IET 2815 (30 DAT). The higher fertility level coupled with heavy plant density per unit area favoured the incidence of this pest particularly in Jaya. (Table A.17). White ear counts

Table A.16. Number of brown planthopper per hill as influenced by variety, nitrogen and plant density.

| | Jaya 30 DAT | Jaya 50 DAT | Maturity | IET 2815 30 DAT | IET 2815 50 DAT | Maturity |
|---|---|---|---|---|---|---|
| 1. 150 kg N/ha; 10x10cm | 0.5 | 1.05 | 0.1 | 0.2 | 0.45 | 0.1 |
| 2. ,, 20x20 cm | 0.7 | 0.70 | 0.1 | 0.6 | 0.50 | 0.1 |
| 3. 75 kg N/ha; 10x10 cm | 0.3 | 0.30 | 0.0 | 0.0 | 0.40 | 0.1 |
| 4. ,, 20x20 cm | 0.5 | 0.40 | 0.0 | 0.4 | 0.35 | 0.1 |
| Mean | 0.5 | 0.61 | - | 0.3 | 0.43 | 0.1 |

recorded at harvest showed a different trend, however. Wider spacing favoured the incidence of stem borer in the reproductive phase and the intensity of incidence was independent of the fertility level.

Table A.17. Incidence of stem borer (percentage) as influenced by variety, spacing and nitrogen.

| | Jaya 30 DAT | Jaya Maturity | IET 2815 30 DAT | IET 2815 Maturity |
|---|---|---|---|---|
| 1. 150 kg N/ha; 10 x 10 cm | 15.0 | 0.57 | 12.1 | 0.57 |
| 2. ,, 20 x 20 cm | 12.0 | 0.71 | 10.5 | 0.68 |
| 3. 75 kg N/ha; 10 x 10 cm | 13.0 | 0.68 | 11.0 | 0.52 |
| 4. ,, 20 x 20 cm | 9.0 | 0.99 | 12.3 | 0.68 |
| Mean | 12.3 | 0.75 | 11.5 | 0.61 |

The data gathered on pest incidence indicated, in general that Jaya was more susceptible to stem borer and brown planthopper than IET 2815 during the vegetative phase.

The data on grain yield showed significant differences between varieties and spacings. There was no marked difference between the fertility levels. Jaya outyielded IET 2815 inspite of the fact that it was relatively more susceptible to insect pests. The latter variety, however, was earlier in duration by about 24 days compared to the former. The wider spacing of 20 cm x 20 cm yielded 3282 kg/ha on an average, the increase in production being 545 kg/ha over the closer spacing (Table A.18).

Table A.18. Grain yield as influenced by variety, nitrogen and plant density

| Variety | Yield (kg/ha) | N level (kg/ha) | Yield (kg/ha) | Spacing (cm) | Yield (kg/ha) |
|---|---|---|---|---|---|
| Jaya | 3465 | 150 | 2937 | 10 x 10 | 2737 |
| IET 2815 | 2554 | 75 | 3082 | 20 x 20 | 3882 |
| C.D.(0,05) | 614 | | NS. | | 172 |

Nitrogen use efficiency and nitrogen balance

The objective of this study was to monitor nitrogen supply in the low land rice soils at different fertility levels. The study consisted of 3 fertility levels (no fertilizer, $P_2O_5$ and $K_2O$ at 15 kg each per ha; N, $P_2O_5$ and $K_2O$ at 50, 15, 15 kg respectively, per ha) in the whole plots and 4 factorial combinations of 2 varieties (RP 4-14; Ptb.20) and 2 spacings (20 cm x 20 cm; 20 cm x 10 cm) in the sub plots. The design of the experiment was split plot with 4 replications.

Nitrogen was observed to be the most limiting factor in rice production in the low land rice soils. Application of nitrogen at 50 kg/ha resulted in an yield increase of 1445 kg/ha over the treatment receiving $P_2O_5$ and $K_2O$ but no additional nitrogen, the increase in yield being of the order of 28.9 kg of grain per kg of applied nitrogen. Applied phosphate and potash resulted in an yield increase of 266 kg/ha only over the unmanured control. This difference in yield was not significant statistically thereby showing no response to applied phosphorus and potash.

The tall local variety Ptb.20 produced significantly higher yield over the dwarf, RP 4-14, the difference in yield being 442 kg/ha. The latter was severely affected by 'Kresek' disease (BLB) during the vegetative phase while Ptb.20 was not affected by the disease.

The best spacing was found to be 20 cm x 10 cm for both the varieties. It registered 6117 kg of grain per ha while 20 cm x 20 cm spacing yielded only 5129 kg grain per ha. Closer spacing of 20 cm x 10 cm thus proved to be more favourable for rice production to the sunny and hot second crop season.

Table A.19. Grain yield corresponding to different varieties, fertility levels and spacings.

| Variety | | Fertility level (kg NPK/ha) | | | Plant spacing (cm) | |
|---|---|---|---|---|---|---|
| Ptb.20 | RP 4-14 | 0-0-0 | 0-45-45 | 50-45-45 | 20x20 | 20 x 10 |
| 5844 | 5402 | 4964 | 5230 | 6675 | 5129 | 6117 |
| C.D.(0.05) | 419 | | 663 | | 419 | |

# C H E M I S T R Y A N D P H Y S I O L O G Y

Long term experiments

Two long term experiments are being conducted in the Block A of the Rice Research Station in order to study the effect of continuous application of organic manures and fertilizers on soil properties and growth and yield of transplanted rice. The first experiment, designated as permanent manurial trial, old, was initiated in 1962 using Ptb.2 and Ptb.20 as test varieties, respectively, during the first and second crop seasons. The second long term experiment was started in 1973 with Jaya (dwarf indica) as test variety. The treatments for both the experiments are similar but the doses of plant nutrients are different. The doses of nitrogen phosphorus and potash are, respectively, 40, 20, 20 lb. per acre for the tall indica variety (first trial) and 90, 45, 45 kg per ha for the dwarf indica rice (second trial). Nitrogen was applied in the form of green leaf, farm yard manure or ammonium sulphate or a combination of all these while phosphorus and potash were applied, respectively, as superphosphate and muriate of potash (Table C.1 and C.2).

Ac.1.1.1.15.

Permanent manurial trial, old

Cattle manure applied at the rate of 8000 lb/ac (40 lb N/ac) gave significantly higher yield over the other manurial treatments in the rainy first crop season, while in the second crop season a combination of cattle manure (2000 lb/ac), green leaf (2000 lb/ac) and NPK fertilizers (20:20:20 lb/ac) produced the highest yield. This treatment ranked second in production efficiency during the first crop season. Continuous application of nitrogen (ammonium sulphate), in the absence of phosphorus and potash, reduced the yields in both the seasons (Table C.1 ).

Table C.1. Panicles/hill and grain yield corresponding to different treatments in the permanent manurial trial, old

| Treatment | Panicles/hill | | Grain yield (kg/ha) | |
|---|---|---|---|---|
| | First crop | Second crop | First crop | Second crop |
| 1. Cattle manure at 8000 lb/ac | 5.8 | 8.4 | 3442 | 3490 |
| 2. Green leaf at 8000 lb/ac | 5.6 | 10.0 | 2644 | 3179 |
| 3. Cattle manure + green leaf at 4000 lb each/ha | 5.7 | 9.1 | 3165 | 3544 |
| 4. Am.sulphate at 200 lb/ac | 6.6 | 12.6 | 2773 | 3030 |
| 5. Cattle manure at 4000 lb/ac + Amm.sulphate at 100 lb/ac | 6.3 | 10.4 | 3185 | 3632 |
| 6. Green leaf at 4000 lb/ac + Amm.sulphate at 100 lb/ac + Superphosphate at 125 lb/ac + muriate of potash at 33 lb/ac | 6.8 | 11.3 | 3152 | 2612 |
| 7. Cattle manure at 2000 lb/ac + green leaf at 2000 lb/ac + Am.sulphate at 100 lb/ac + superphosphate at 125 lb/ac + muriate of potash at 33 lb/ac | 6.0 | 10.4 | 3219 | 3801 |
| 8. Am.sulphate at 200 lb/ac + superphosphate at 125 lb/ac+ muriate of potash at 33 lb/ac | 6.7 | 13.1 | 3117 | 3388 |
| C.D.(0.05) | | | 178 | 255 |

The data on soil analysis showed higher percentage of organic carbon and available potash in plots supplied with cattle manure at 8000 lb/ac. Soil in these plots also showed good water holding capacity. Bulk density of the soil was higher in the plots receiving inorganic fertilizers.

Ag.1.1.1.14.

Permanent manurial trial, new

During both the seasons, combined application of cattle manure (9000 kg/ha) and inorganic fertilizers (N,P,K at 45 kg each/ha) as in treatment 5 favoured the production of higher grain yield. Cattle manure applied alone at the rate of 18,000 kg/ha (90 kg/ha) was on par with this treatment in the first crop season. A combination of cattle manure, green leaf and fertilizers (as in treatment 7) registered nearly as much yield as in treatment 5 in the second crop season. Continuous application of ammonium sulphate alone (without phosphorus and potash) tended to depress growth and production during both the seasons showing thereby the necessity for balanced manuring for higher yields (Table C.2).

Table C.2. Panicles/hill and grain yields corresponding to different treatments in the permanent manurial trial, new.

| Treatment | Panicles/hill First crop | Panicles/hill Second crop | Grain yield (kg/ha) First crop | Grain yield (kg/ha) Second crop |
|---|---|---|---|---|
| 1. Cattle manure at 18,000 kg/ha | 5.2 | 4.6 | 3956 | 2591 |
| 2. Green leaf at 18,000 kg/ha | 6.3 | 6.1 | 3517 | 2185 |
| 3. Cattle manure + green leaf at 9000 kg each/ha | 6.[illegible] | 5.6 | 3815 | 2821 |
| 4. Amm.sulphate at 450 kg/ha | 7.1 | 6.1 | 3431 | 2259 |
| 5. Cattle manure at 9000 kg/ha + amm.sulphate at 225 kg/ha + superphosphate at 281 kg/ha+ muriate of potash at 75 kg/ha | 5.8 | 5.3 | 4004 | 3149 |
| 6. Green leaf at 9000 kg/ha + Am. sulphate, super and potash as in Treatment 6. | 6.4 | 6.7 | 3791 | 2836 |
| 7. Cattle manure at 4500 kg/ha + green leaf at 4500 kg/ha + Am. sulphate, super and potash as in treatent 5. | 6.1 | 5.7 | 3876 | 3056 |
| 8. Am.sulphate at 450 kg/ha + superphosphate at 281 kg/ha + muriate of potash at 75 kg/ha | 6.8 | 6.2 | 3559 | 2769 |
| C.D. (0,05) | | | 119 | 242 |

Soil analysis after the harvest of crop showed that cattle manure application was highly favourable for increasing the organic carbon content and water holding capacity.

Ag.1.1.1.18.

<u>Foliar nutrition of rice</u>

Relative efficiency of soil and foliar applications of urea on the growth and yield of Jaya rice was studied in this experiment. The treatments comprised of 3 levels of nitrogen (45, 65, 85 kg/ha) in the form of urea and two methods of application (soil, foliar). For foliar feeding, 15 percent solution of urea was sprayed using a low volume sprayer.

Table C.3. Effect of levels and methods of application of nitrogen on the yield of Jaya rice.

| Treatment | Panicles/hill | | Grain yield (kg/ha) | |
|---|---|---|---|---|
| | First crop | Second crop | First crop | Second crop |
| 1. 45 kg N/ha as soil application (½ as basal; ¼ at tillering; ¼ at panicle initiation) | 5.4 | 4.7 | 5284 | 2194 |
| 2. 45 kg N/ha (½ as basal; ½ as foliar spray in 2 equal doses) | 5.0 | 4.5 | 5934 | 2212 |
| 3. 45 kg N/ha as foliar spray in 2 equal doses | 5.1 | 4.1 | 4958 | 1500 |
| 4. 65 kg N/ha as soil application as in treatment 1. | 5.2 | 4.8 | 5270 | 2277 |
| 5. 65 kg N/ha as in tr.2. | 5.3 | 5.0 | 5187 | 2347 |
| 6. 65 kg N/has as foliar spray as in tr.3. | 5.5 | 4.4 | 5180 | 1752 |
| 7. 85 kg N/ha as soil application as in tr.1. | 5.1 | 5.2 | 5229 | 2286 |
| 8. 85 kg N/ha as in Tr.2. | 5.1 | 4.9 | 5236 | 2333 |
| 9. 85 kg N/ha as foliar spray as in tr.3. | 5.6 | 4.0 | 5125 | 1416 |
| CD(0,05) | | | 290 | 393 |

Response to applied nitrogen was only moderate during both the seasons probably due to high initial fertility of the soil. At all the levels of nitrogen, soil application of urea was on par with soil plus foliar application in its effect on grain yield during both the seasons. Foliar feeding in the absence of basal dressing of nitrogen, produced lower yields consistently.

The results are presented in Table C.3.

Ag.1.1.1.16.
Crop weather studies

Weather and yield are intimately related. Yields are high when weather conditions are optimum for growth and development. Much of the fluctuations in production are the result of vagaries of weather. The reaction of new varieties to changes in weather conditions was studied in this experiment.

Eight varieties of rice belonging to early, medium and late maturity groups were planted every month commencing from July 1975 and data gathered on flowering duration, panicles/hill, total dry matter, number of grain/panicle, spikelet sterility and grain yield. Each variety had 4 replications in a randomised complete block design. The fertility level was 60 kg N, 30 kg $P_2O_5$ and 30 kg $K_2O$ per ha.

Most of the varieties produced higher amounts of dry matter when they were planted in the months of July and November. Dry matter yield fluctuated in response to changes in the month of planting (Table C.5).

Jyothi, Bharathi and Mashoori reacted significantly to the period of the planting season. Whilst these varieties produced higher yields in the July, their productivity declined when planted in the other months.

Plantings done in the hot and dry months of January, February and March reduced the yield potential of Cauvery to a considerable extent. RP 4-14 showed fairly stable productivity upto the months of December; thereafter its yield tended to decline. IET 3257, RPN 6-17 and IET 1444 performed satisfactorily in all the months of planting. They can be rated, therefore, as stable yielders (Table C.6 ).

Table C.4. Flowering duration (days) as influenced by date of planting

| Month / Variety | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar |
|---|---|---|---|---|---|---|---|---|---|
| Cauvery | 79 | 71 | 75 | 65 | 75 | 81 | 83 | 81 | 84 |
| IET 1444 | 85 | 80 | 81 | 72 | 79 | 81 | 93 | 88 | 81 |
| RP 4-14 | 102 | 90 | 83 | 72 | 74 | 109 | 95 | 93 | 88 |
| Jyothi | 96 | 84 | 81 | 79 | 90 | 91 | 95 | 88 | 85 |
| Bharathi | 102 | 93 | 88 | 79 | 97 | 107 | 109 | 93 | 86 |
| Mashoori | 110 | 104 | 102 | 92 | 93 | 107 | 114 | 110 | 107 |
| RPN 6-17 | 115 | 104 | 102 | 92 | 106 | 115 | 125 | 121 | 107 |
| IET 3257 | 119 | 110 | 106 | 96 | 102 | 110 | 111 | 121 | 112 |

Table C.5. Total dry matter production/hill(g) as influenced by date of planting.

| Month / Variety | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. |
|---|---|---|---|---|---|---|---|---|---|
| Cauvery | 16.0 | 16.9 | 14.7 | 11.0 | 19.4 | 20.9 | 12.1 | 16.1 | 16.8 |
| IET 1444 | 13.9 | 16.7 | 14.2 | 19.8 | 19.5 | 22.4 | 21.6 | 16.2 | 18.7 |
| RP 4-14 | 21.7 | 20.1 | 24.8 | 20.1 | 19.4 | 19.3 | 17.9 | 19.0 | 15.9 |
| Jyothi | 19.1 | 18.1 | 16.2 | 18.5 | 15.9 | 23.7 | 17.1 | 15.5 | 15.9 |
| Bharathi | 22.0 | 20.1 | 22.3 | 20.0 | 24.6 | 23.2 | 22.1 | 16.6 | 21.4 |
| Mashoori | 32.6 | 28.4 | 20.0 | 24.4 | 26.1 | 24.4 | 17.5 | 19.1 | -- |
| RPN 6-17 | 21.3 | 24.7 | 21.0 | 27.1 | 30.2 | 22.7 | 24.0 | 25.8 | 30.8 |
| IET 3257 | 31.6 | 36.1 | 28.3 | 30.5 | 37.8 | 28.4 | 22.2 | 26.6 | 33.8 |

Table C.6. Grain yield per hill (g) as influenced by date of planting

| Month / variety | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. |
|---|---|---|---|---|---|---|---|---|---|
| Cauvery | 7.4 | 8.0 | 7.2 | 5.9 | 8.3 | 8.9 | 5.1 | 5.9 | 5.0 |
| IET 1444 | 7.5 | 7.2 | 7.2 | 8.1 | 9.6 | 9.0 | 8.1 | 6.4 | 8.2 |
| [illegible] 4-14 | 10.7 | 9.6 | 10.8 | 10.6 | 8.8 | 9.9 | 7.0 | 7.5 | 7.5 |
| Jyothi | 11.6 | 9.2 | 8.7 | 8.11 | 7.0 | 9.7 | 6.8 | 5.8 | 7.5 |
| Bharathi | 11.6 | 9.6 | 9.5 | 9.9 | 9.8 | 8.8 | 9.1 | 3.1 | 9.1 |
| Mashoori | 13.8 | 10.2 | 10.9 | 7.9 | 8.8 | 9.6 | 4.8 | 5.6 | - |
| RET 6-17 | 8.1 | 8.3 | 11.7 | 10.9 | 10.1 | 9.0 | 9.9 | 10.4 | 7.3 |
| IET 3257 | 11.4 | 9.1 | 10.3 | 11.8 | 10.6 | 11.0 | 7.1 | 9.8 | 8.8 |

Physiological Research under the All India Coordinated Rice Improvement Project.

Ag.ICAR 1.1.1.17.

Physiological age of seedling

The effect of seedling age *per se* on productivity of short and mid term varieties was assessed in this experiment.

The treatments included 4 varieties belonging to early and medium duration groups, (IET 1444, Jaya, Vijaya and Mashoori), 2 spacings (10 cm x 10 cm; 20 cm x 20 cm) and 3 physiological age groups (4-6 leaf stage; 8-9 leaf stage; 11-12 leaf stage) as determined by leaf number. Staggered sowing was done in order to facilitate transplanting of seedlings of all the age groups on the same day.

Age of seedlings did not exert much variation in dry matter accumulation per hill at harvest under the closer spacing. On the other hand, a significant decline in dry matter production was observed in Jaya and Vijaya when they were planted wide (Table C.7). A reduction in flowering duration occured in all the varieties when seedlings older than 5-6 leaf age were planted.

Table C.7. Dry matter production, panicles/m$^2$, flowering duration and grain yield as influenced by age of seedling and plant density.

| Variety | Seedling age (leaf-stage) | Total dry matter (g) Spacing (cm) | | No. of panicles/ha Spacing (cm) | | Grain yield tons/ha Spacing (cm) | |
|---|---|---|---|---|---|---|---|
| | | 10x10 | 20x20 | 10x10 | 20x20 | 10x10 | 20x20 |
| IET 1444 | A1 | 9 | 25 | 433 | 268 | 4.75 | 3.30 |
| | A2 | 7 | 23 | 483 | 360 | 2.93 | 3.17 |
| | A3 | 6 | 23 | 593 | 402 | 3.19 | 3.14 |
| Jaya | A1 | 7 | 22 | 366 | 233 | 3.14 | 2.17 |
| | A2 | 8 | 19 | 430 | 260 | 4.54 | 2.87 |
| | A3 | 6 | 14 | 453 | 198 | 3.26 | 1.91 |
| Vijaya | A1 | 7 | 23 | 383 | 230 | 2.97 | 2.77 |
| | A2 | 6 | 18 | 373 | 210 | 3.43 | 2.42 |
| | A3 | 6 | 14 | 390 | 215 | 2.90 | 1.91 |
| Mashoori | A1 | 9 | 27 | 383 | 293 | 2.67 | 2.68 |
| | A2 | 9 | 25 | 493 | 204 | 2.81 | 2.18 |
| | A3 | 9 | 24 | 360 | 238 | 3.69 | 2.51 |
| CD (0.05) | Spacing (s) | 3.73 | | 29.43 | | 0.20 | |
| | Variety (v) | 1.94 | | N.S. | | 0.37 | |
| | Age (a) | 1.68 | | 31.13 | | N.S. | |

A1, 5-6 leaves; A-2, 8-9 leaves; A3. 11-12 leaves.

Older seedlings produced larger number of panicles per sq.meter in all the varieties. This phenomenon was more pronounced in IET 1444 and Jaya.

IET 1444 produced the maximum grain yield when seedlings were planted close (10 cm x 10 cm) at the age of 5-6 leaves. Under wider spacing, age of seedling had no marked influence on the productivity of this variety. Under 10 x 10 cm spacing, Jaya and Vijaya exhibited higher productivity when they were transplanted at the age of 8-9 leaves. Older seedlings were of considerable advantage in Mashoori. Seedlings aged 12-13 leaves registered higher yields over those of the other age groups in this variety. Effect of age of seedlings became less pronounced when seedlings were planted wide. This was true for all the varieties tested.

Association between harvest index and biological yield

Harvest index is the ratio between economic yield and total dry matter. It indirectly indicates the functional efficiency of the plant. The present investigation was undertaken to understand the interrelationship between biological yield (total dry matter) and harvest index and between economic yield and harvest index.

The data on total dry matter production and grain yield were gathered from 10 varieties raised in the uniform variety trial-1 (early group) during the first crop season. Ten hills from each variety were harvested and dried and economic yield and biological yields were assessed. The data are presented in Table C.8.

Biological yield did not show any association with harvest index. The check variety Cauveri had a lower biological yield (16 g/hill) but its harvest index was higher (56%) than those of the other varieties. Anupama, another check variety, registered a harvest of 52 percent at a biological yield of 29 g/hill (Table C.8).

The harvest index of the test varieties ranged from 39 percent as in CR 79-23A to 56 percent as in Cauveri and IET 2815. Superior varieties can be identified using the harvest index. Varieties with a harvest index of less than 50 percent can be considered generally as poor yielders.

The relationship between harvest index and economic yield was almost linear. An increase in the economic yield was associated with a corresponding increase in the harvest index.

Table C.8. Biological yield, economic yield and harvest index of varieties in UVT-1, first crop, 1975-76.

| Variety | Biological yield (g/hill) | Economic yield (g/hill) | Harvest index (percentage) |
|---|---|---|---|
| IET 1444 | 17 | 7 | 41 |
| 2707 | 16 | 8 | 50 |
| 2813 | 18 | 9 | 50 |
| 2815 | 16 | 9 | 56 |
| 2845 | 19 | 9 | 47 |
| 2881 | 16 | 8 | 50 |
| RP 79-23 A | 18 | 7 | 39 |
| IET 2967 | 19 | 10 | 52 |
| IET 3116 | 20 | 10 | 50 |
| IET 3125 | 20 | 11 | 55 |
| 3126 | 18 | 9 | 50 |
| 3127 | 18 | 10 | 55 |
| 3262 | 18 | 8 | 44 |
| 3319 | 16 | 7 | 43 |
| 4555 | 20 | 10 | 50 |
| 4556 | 20 | 11 | 55 |
| Anupama | 20 | 11 | 52 |
| Cauveri | 16 | 9 | 56 |
| Jatna | 18 | 10 | 55 |

## Effect of waterlogging

This investigation was undertaken with the objective of elucidating information on the effect of waterlogging during different growth phases of transplanted rice. The treatments were:

1. Water logging during vegetative phase only.
2. Waterlogging during reproductive phase only.
3. Waterlogging during ripening phase only.
4. Control: 3-5 cm water column from planting to maturity.

The test varieties were, T 442-2-58, Mashoori, IET 8257, RP 193-1, RPW 6-17 and RP 270-48-4.

Waterlogging during the vegetative phase markedly reduced the number of tillers per unit area. Shallow flooding as in treatment 4 favoured the production of large number of panicles in all the varieties. Waterlogging did not exert significant influence on plant height and number of grains per panicle.

Grain yields tended to decline when the plants were subjected to waterlogging at different growth phases. The magnitudes of reduction in yield on account of waterlogging at the vegetative, reproductive and ripening phases were, respectively, 2 percent, 7 percent and 8 percent compared with shallow submergence (100%). Mashoori showed better productivity under all the water management treatments. It indicates that Mashoori is better adapted to waterlogged conditions.

The results are presented in Table C.9.

Table C.9. Effect of waterlogging at different growth stages on panicles, grains/panicle and grain yield under field conditions

| Variety | Panicle per $m^2$ | | | | Grain yield $(g/m^2)$ | | | | Grain/panicle (number) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1. IR 412-2-58 | 363 | 330 | 330 | 330 | 336 | 330 | 297 | 330 | 83 | 74 | 77 | 78 |
| 2. CR 139-198 | 231 | 198 | 198 | 231 | 396 | 396 | 396 | 363 | 92 | 107 | 114 | 99 |
| 3. RP 270-484 | 330 | 297 | 264 | 297 | 198 | 264 | 264 | 198 | 81 | 108 | 111 | 97 |
| 4. RPW 6-17 | 330 | 264 | 231 | 297 | 462 | 462 | 462 | 396 | 102 | 107 | 102 | 95 |
| 5. RP 193-1 | 363 | 297 | 264 | 297 | 363 | 264 | 297 | 330 | 95 | 130 | 94 | 94 |
| 6. Mashoori | 264 | 231 | 231 | 264 | 528 | 528 | 439 | 495 | 188 | 173 | 155 | 152 |
| Mean | 314 | 270 | 253 | 286 | 380 | 374 | 359 | 352 | 107 | 116 | 109 | 99 |
| % of control | 100 | 85 | 90 | 91 | 100 | 98 | 93 | 92 | 100 | 108 | 101 | 92 |

# E N T O M O L O G Y

One of the major constraints to higher rice production in Kerala is represented by insect pests. Most of the high yielding varieties are highly susceptible to pests. In the absence of resistant varieties, insecticides play an important role in stepping up production. Screening of new chemicals, therefore, assumes importance. In order to identify safe but potent insecticides for the control of specific pests of rice. With this objective in view, twofield trials were initiated in 1974-75. These trials were continued in 1975-76 also.

Ag.1.1.8.2.
Evaluation of granular insecticides

The insecticidal efficacy of eight granular chemicals on the control of major insect pests of rice was investigated in this experiment. The chemicals included Furadan 3 G, Thimet 10 G, Cytrolane 5 G, Solvirex 5 G, Ekalux 5 G and Sevidol 4:4 G. All the chemicals except Furadan were treated at 1.0 kg a.i/ha. Furadan was applied at 0.5 kg a.i/ha.

The test variety Jaya was transplanted under high fertility conditions in order to induce pest incidence. The first application of the chemicals was done on the 10th day after planting. A second application was necessitated on the 50th day after planting on account of sporadic incidence of leaf roller on the crop.

The design of the experiment was randomised block with 4 replications.

Cytrolane was the only chemical to exhibit a high degree of efficacy against gall midge, the rate of incidence being only 3.48 percent compared with 13.81 percent in Furadan, 15.96 percent in Galecron, 16.46 percent in Sevidol and 18.07 percent in the untreated control, (Table E.1.).

Table E.1. Effect of granular insecticides on gall midge, stem borer and leaf roller

| Insecticides | Rate of appln. (kg a.i/ha) | % incidence of | | | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| | | silver shoot | dead hearts | leaf roller | |
| 1. Furadan | 0.5 | 13.81 | 4.14 | 13.97 | 2899 |
| 2. Thimet | 1.0 | 11.81 | 9.19 | 37.12 | 2084 |
| 3. Galecron | 1.0 | 15.96 | 4.12 | 4.43 | 3834 |
| 4. Azodrin | 1.0 | 16.60 | 6.94 | 31.75 | 2480 |
| 5. Cytrolane | 1.0 | 3.48 | 5.37 | 25.18 | 3788 |
| 6. Solvirex | 1.0 | 16.29 | 5.31 | 36.32 | 2519 |
| 7. Ekalux | 1.0 | 11.35 | 7.88 | 34.25 | 2444 |
| 8. Sevidol | 1.0 | 16.46 | 6.20 | 33.88 | 2568 |
| 9. Untreated control | - | 18.07 | 9.79 | 39.17 | 2484 |
| C.D.(0.05) | | 5.34 | 4.66 | 7.75 | 500 |

Galecron, Furadan, Solvirex, Cytrolane, Sevidol, Azodrin and Ekalux gave adequate control of stemborer in the vegetative phase. The rate of incidence of the pest ranged from 4.12 percent in Galecron to 9.79 percent in the unprotected control.

Galecron showed fast knock down effect on leaf roller when it was applied immediately after noticing the pest on the crop. The intensity of damage in the Galecron treated plot was only 4.43 percent as against 39.17 percent in the unprotected check. None of the chemicals was as effective as Galecron against this pest. Thimet was the least effective of all against leaf roller.

Furadan, Galecron and Cytrolane favoured higher grain production, an indication of their efficacy against insect pests. These insecticides were significantly superior to the others tested in their effect on grain y

A.1.1.8.3.

Field evaluation of new insecticides

Efficiency of nine new insecticides on the control of specific pests of rice was tested in this experiment. The treatments included in addition to these chemicals in emulsifiable concentrate form, a standard insecticidal check and an unprotected control (Table E.2.). The chemicals were sprayed

Table E.2. Effect of insecticides on the control of gall midge, stemborer and leaf roller

| Insecticide | Formulation concentration (%) | Rate of appln. (kg a.i/ha) | % incidence of | | | Grain yield (kg/ha) |
|---|---|---|---|---|---|---|
| | | | silver shoot | dead heart | leaf roller | |
| 1. BHC | 50 | 0.52 | 13.9 | 14.6 | 28.6 | 2880 |
| 2. Sevin | 50 | 0.50 | 11.7 | 11.1 | 18.9 | 3544 |
| 3. Phosvel | 34 | 0.25 | 14.0 | 13.3 | 7.1 | 3970 |
| 4. Dimecron | 100 | 0.25 | 13.4 | 13.5 | 22.4 | 3552 |
| 5. Ekalux | 25 | 0.25 | 12.8 | 11.6 | 12.4 | 3987 |
| 6. Nuvacron | 40.8 | 0.25 | 15.2 | 13.7 | 16.7 | 3714 |
| 7. Lebaycid | 100 | 0.25 | 13.1 | 14.3 | 27.6 | 3759 |
| 8. Bidrin | 24 | 0.25 | 11.6 | 11.9 | 17.3 | 3480 |
| 9. Folithion | 50 | 0.25 | 11.1 | 14.1 | 25.7 | 3041 |
| 10. Parathion | 50 | 0.25 | 11.4 | 15.5 | 17.2 | 3803 |
| 11. Untreated control | -- | -- | 13.5 | 16.1 | 33.5 | 2464 |
| L.D. (0.05) | | | N.S. | N.S. | 5.9 | 686 |

on the crop at initial tillering (10 DAT) and maximum tillering stages. The second spraying was necessitated by severe leaf roller incidence at the reproductive stage.

The design of the experiment was randomised block with 4 replications. The test variety was Jaya.

The intensity of incidence of gall midge and stem borer was not serious enough to cause considerable crop loss. Leaf roller, on the contrary, inflicted heavy damage to the crop. The rates of damage due to this pest ranged from 7.1 percent in Phosvel to 33.6 percent in the unprotected control (Table E.2). Phosvel and Ekalux were statistically on par in their effect on leaf roller. The other chemicals were not as effective as Phosvel and Ekalux.

All the chemicals except BHC 50% and Folithion produced significantly higher yields over the untreated control. Ekalux and Phosvel, however, were relatively more superior to Lebaycid, Nuvacron, Parathion, Dimecron, Sevin and Bidrin possibly because of their knock down effect on leaf roller.

Ag.1.1.8.6.

Biotypes of brown planthopper

Rice varieties identified as resistant at the IRRI, Philippines reacted as susceptible in Kerala in the trials conducted during 1973-74. This led to the conclusion that different biotypes could develop through natural selection if the pest is reared on resistant varieties for several generations. The brown planthopper in Kerala appears to be of a different biotype compared with those found in the Philippines. The present investigation was initiated to find out biotype differences, if any, in the brown planthopper population found in Kerala and to identify rice varieties resistant to all biotypes.

Varieties possessing different major genes for resistance to brown planthopper were grown in seed boxes along with the susceptible variety Taichung (Native)1 and resistant variety, Ptb.33. When the seedlings were 10-15 days old, they were exposed to 1 to 5 day - old nymphs of brown planthopper at the rate of 10 nymphs per seedling. Reaction of seedlings to brown planthopper was rated (0 to 9 scale) when 90 percent of the plants of the susceptible variety succumbed to the pest.

The results of the laboratory screening trial conducted with forty varieties are presented in Table E.3.

The data indicated that all the 4 varieties identified in the philippines as having monogenic dominant resistance (as in Mudgo, Bph 1; Rathu heenati, Bph 3) or monogenic recessive resistance (as in Asd 7, bph 2; Babawee, Bph 4) to brown planthopper were susceptible to the biotype found in Kerala. Only three varieties showed resistant reaction to this 'biotype'. They were, ARC 6650 (score: 2.5), Ptb.19 (score: 2.0) and Ptb.33 (score: 2.6). Corroboratory results were observed in the trials conducted at Rajendranagar, Pantnagar and Cuttack.

Table E.3. Reaction of rice varieties to brown planthopper

| Sl. No. (1) | Designation (2) | Country of origin (3) | Damage score (0 to 9 scale)(4) |
|---|---|---|---|
| 1. | IR 969/IR 8 | Taiwan | 3.6 |
| 2 | C62-1-230 | ,, | 8.9 |
| 3. | C 62-1-373 | ,, | 5.4 |
| 4. | CR 94-13 | India | 6.8 |
| 5. | Hamsa | ,, | 7.9 |
| 6. | IR 26 | Philippines | 6.5 |
| 7. | IR 1154-243-1 | ,, | 7.8 |
| 8. | IR 1364-37-3-1-1-1 | ,, | 6.1 |
| 9. | IR 1480-125-2-3-10 | ,, | 6.6 |
| 10. | IR 1514-A-E 597 | ,, | 8.5 |
| 11. | IR 1539-823-4-1 | ,, | 5.3 |

contd.....

Table E.3.contd..

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 12. | IR 1628-632-1 | Philippines | 4.9 |
| 13. | IR 1632-93-2-2 | ,, | 5.8 |
| 14. | Jayanthi | India | 8.2 |
| 15. | RP 9-6 | ,, | 5.2 |
| 16. | T(N)1 | ,, | 7.9 |
| 17. | Thriveni | ,, | 6.8 |
| 18. | Andaragahavewa | Sri Lanka | 4.6 |
| 19. | ARC 6650 | India | 2.5 |
| 20. | ASD 7 | ,, | 7.5 |
| 21. | Babawee | Sri Lanka | 5.8 |
| 22. | Co 9 | India | 3.9 |
| 23. | D[illegible] Sanna | ,, | 8.8 |
| 24. | Gangula | Sri Lanka | 6.9 |
| 25. | H.5 | ,, | 6.6 |
| 26. | H. 105 | ,, | 6.4 |
| 27. | Jyothi | India | 7.1 |
| 28. | Kentjana | Indonesia | 4.9 |
| 29. | Dekewee 328 | Sri Lanka | 1.7 |
| 30. | Mudgo | India | 6.5 |
| 31. | Murungakayan 3 | Sri Lanka | 7.6 |
| 32. | Murungakayan 101 b | ,, | 5.4 |
| 33. | Murungakayan 303 b | ,, | 7.7 |
| 34. | Mallar [illegible] | ,, | 7.6 |
| 35. | Palasithari 601 | ,, | 7.6 |
| 36. | Ptb.19 | India | |
| 37. | Ptb.21 | ,, | 4.5 |
| 38. | Rathu Henati | Sri Lanka | 8.3 |
| 39. | Red Rice | Iran | 8.1 |
| 40. | SLO 12 | India | 6.3 |
| 41. | Ptb. 33 (Resistant check) | ,, | 2.6 |
| 42. | T(N) 1 Susceptible check | | 8.8 |

Ag.1.1.8.4.

## Varietal reaction to insect pests

The objective of this experiment was to study the reaction of pre-release varieties to major insect pests of rice.

Fifty-three varieties (Table E.4) developed at the rice research stations in Kerala were planted in rows in a heavily fertilized field and their reaction to gall midge, stem borer and brown planthopper was studied. Jaya was used as a susceptible check variety.

The cultures of MO 11,42-3-3, MO 11,57-5-1, MO 9,50-2-1, MO 9-87-5, MO 17-34-4, MO 21,30-1-1 and MN 79-60 showed resistant reaction to gall midge. The intensity of incidence of this pest was less than 5 percent in these varieties compared with 13.85 percent in Jaya.

A number of entries exhibited field tolerance to stem borer at the vegetative phase. The most tolerant among them were, MO 15,34-1-1, MO 8-87-5-2, MO 17,34-4, MO 14-2-3, MO 18,14-2 and PTB 7944.

The following pre-release cultures showed tolerance to brown planthopper under laboratory conditions: MO 11,42-3-3, MO 21,30-1-1, MO 14-2-3, MO 18,18-4-3, MO 9-50-2-2, MN 703, PTB 1-5-4, PTB 21592. They showed a damage score of less than 5 in the seedling test.

Table E.4. Reaction of pre-release cultures to gall midge, stem borer and brown planthopper

| Sl. No. | Designation | Reaction to pests: Silver Shoot (%) | Dead heart (%) | BPH (Score 0-9) |
|---|---|---|---|---|
| 1. | MO 12,5-1 | 5.29 | 11.25 | - |
| 2. | ,, 11,42-3-3 | 2.38 | 1.49 | 4.1 |
| 3. | ,, 21,14-1 | 10.42 | 3.08 | - |
| 4. | ,, 15,34-1-1 | 8.59 | 11.37 | 9.0 |

contd...

Table E.4. Reaction of pre-release cultures to gall midge, stem borer and brown planthopper.

| Sl. No. | Designation | Reaction to pests | | |
|---|---|---|---|---|
| | | Silver shoot (%) | Dead heart (%) | BPH (Score 0-9) |
| 1. | MO 12,5-1 | 5.29 | 11.25 | - |
| 2. | ,, 11,42-3-3 | 2.38 | 1.49 | 4.1 |
| 3. | ,, 21,14-1 | 10.42 | 2.08 | - |
| 4. | ,, 15,34-1-1 | 8.59 | 11.37 | 9.0 |
| 5. | ,, 11,57-5-1 | 4.43 | 11.16 | 9.0 |
| 6. | ,, 15,34-1-1 | 9.09 | 0.28 | 9.0 |
| 7. | ,, 9,50-2-1 | 4.88 | 11.29 | 9.0 |
| 8. | ,, 9,87-5 | 3.01 | 11.00 | 9.0 |
| 9. | ,, 8,87-5 | 5.90 | 0.22 | 9.0 |
| 10. | ,, 11,84-2 | 7.38 | 4.83 | 9.0 |
| 11. | ,, 17,31-4 | 3.63 | 0.60 | - |
| 12. | ,, 11,51-2 | 5.67 | 1.48 | 5.0 |
| 13. | ,, 21,30-1-1 | 4.81 | 11.10 | 5.0 |
| 14. | ,, 14,2-3 | 9.99 | 0.34 | 4.0 |
| 15. | ,, 18,14-2 | 6.10 | 10.25 | 9.0 |
| 16. | ,, 21,30-1-2 | 9.06 | 12.92 | 9.0 |
| 17. | ,, 8,48-1 | 15.31 | 11.16 | - |
| 18. | ,, 13,118-2 | 8.21 | 3.48 | - |
| 19. | ,, 18,18-13 | 6.57 | 2.55 | 1.0 |
| 20. | ,, 18,18-2 | 7.14 | 9.06 | 9.0 |
| 21. | ,, 19,25-1 | 7.40 | 5.47 | 9.0 |
| 22. | ,, 15,6-3 | 8.10 | 7.39 | - |
| 23. | ,, 16,38-1 | 4.80 | 6.64 | 7.1 |
| 24. | ,, 16,17-4 | 4.68 | 9.03 | 3.7 |
| 25. | ,, 9,50-2-21 | 5.42 | 6.14 | 5.0 |
| 26. | K Cul. 1 | 6.88 | 5.63 | 7.1 |
| 27. | ,, 2 | 9.00 | 3.67 | - |
| 28. | ,, 4 | 9.03 | 2.58 | 7.1 |
| 29. | ,, 16 | 6.29 | 3.15 | 7.6 |

contd.....

Table E.4. contd.

| | | | | |
|---|---|---|---|---|
| 30. | MN. 79-60 | 4.53 | 4.91 | 8.0 |
| 31. | ,, 19-1-1 | 13.66 | 2.33 | 8.7 |
| 32. | ,, 699a-1-1 | 6.71 | 5.65 | - |
| 33. | ,, 203-1-1 | 6.17 | 8.67 | - |
| 34. | ,, 425-1 | 8.05 | 4.36 | - |
| 35. | ,, 703- | 6.99 | 10.06 | 4.0 |
| 36. | ,, 202-1 | 15.33 | 1.94 | 6.7 |
| 37. | ,, 518-2 | 7.22 | 4.38 | 8.0 |
| 38. | Ptb. 23372 | 15.93 | 5.49 | - |
| 39. | ,, 23634-1 | 9.75 | 6.91 | - |
| 40. | ,, 22641 | 10.88 | 4.42 | - |
| 41. | ,, 23332-2 | 11.11 | 7.56 | - |
| 42. | ,, 23098-1 | 10.31 | 10.19 | 7.2 |
| 43. | ,, 925 | 10.95 | 10.19 | 9.0 |
| 44. | ,, 23548 | 9.13 | 8.87 | 8.0 |
| 45. | ,, 22651-2 | 13.43 | 6.02 | 6.7 |
| 46. | ,, 1065 | 11.57 | 11.93 | 7.0 |
| 47. | ,, 1-5-1 | 10.92 | 1.62 | 3.8 |
| 48. | ,, 1012 | 9.04 | 1.26 | 6.7 |
| 49. | ,, 1918 | 6.35 | 2.78 | 5.4 |
| 50. | ,, 7914 | 5.12 | 0.68 | 9.0 |
| 51. | ,, 22611 | 8.13 | 3.21 | 8.4 |
| 52. | ,, 23178 | 8.13 | 3.21 | 8.1 |
| 53. | ,, 21592 | 6.25 | 4.30 | 2.9 |
| 54. | Jaya | 13.85 | 15.66 | 9.0 |

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Ag. ICAR 1.8.84.

New insecticide trial

The relative efficacy of six granular chemicals (Azodrin, Carlin, Thiodan, AC 92-100, Lebaycid and Furadan) on the control of major pests of rice was studied in this experiment. The treatments included, in addition to these chemicals, untreated and maximum protected controls. All the chemicals were tried at 1 kg a.i/ha. The test variety was Jaya.

During the first crop season, the treatment differences on the control of gall midge and stem borer did not touch the level of statistical significance. The intensity of incidence of these pests was too low to cause serious crop damage.

Paddygard, Ekalux (maximum protection) and Furadan proved to be equally effective in gall midge control during the second crop season, the intensity of damage being 6.42 percent, 7.02 percent and 9.17 percent, respectively. The untreated control showed the maximum of 14.72 percent damage. Furadan also gave adequate control of leaf roller at the reproductive stage. As in the previous season, the intensity of incidence of this pest was mild during the second crop season.

Table E.5. Effect of granular insecticides on gall midge incidence and grain yield; second crop season, 1975-76.

| Treatment | Silver shoot (%) | Grain yield (kg/ha) | Increase in yield over control (%) |
|---|---|---|---|
| 1. Paddigard | 6.1 | 4099 | 35.0 |
| 2. Furadan | 9.2 | 5157 | 79.8 |
| 3. AC 29-109 | 11.3 | 3328 | 10.0 |
| 4. Thiodan | 12.7 | 3601 | 19.0 |
| 5. Lebaycid | 13.1 | 3216 | 6.0 |
| 6. Carlin | 13.9 | 3373 | 11.0 |
| 7. Maximum protection | 7.0 | 4347 | 43.0 |
| 8. Untreated control | 14.7 | 3034 | .. |
| C.D. (0.05) | 1.1 | | |

Furadan registered the highest yield of 5457 kg per ha, the percentage of increase being 79.8 compared with the untreated control. The next best chemical was Ekalux (maximum protection). It yielded 4348 kg per ha. Paddygard ranked third in production (Table E.5).

Ag.ICAR 1.8.85.

Field evaluation of new chemicals

The insecticidal efficacy of some of the new chemicals was evaluated in two experiments during 1975-76. The chemicals were applied as foliar spray at 2 doses ie. 0.5 kg and 0.25 kg a.i/ha. The test variety was Jaya.

The chemicals tested in the first crop season included Phosvel, Dursban, Mipcin, Ekalux, Birlane, Dimecron, Ambithion and Folithion. Of these, Ambithion, Phosvel and Ekalux at the lower dose and Dursban at the higher dose gave higher degree of gall midge control. Incidence of stem borer was negligible in Dimecron (0.5 kg a.i/ha), Dursban (both the doses), Ekalux (0.25 kg a.i/ha), Folithion (both the doses) and Phosvel (0.5 kg a.i/ha). Phosvel proved to be highly effective against leaf roller also. The highest yield was produced by Phosvel (1746 kg per ha) at the higher dose. Dursban ranked second in grain production (Table E.6.).

During the second crop season, Bidrin, Fundal, Knocbal, Lebaycid, Phosvel, Sevin, Tameron and Zolone were the chemicals evaluated.

Phosvel (0.25 kg a.i/ha) and Zolone (0.5 kg a.i/ha) were the most effective against gall midge. While Tameron (0.5 kg a.i/ha) showed the least incidence of dead hearts in the vegetative phase, Lebaycid, Sevin, Tameron (0.5 kg a.i/ha) and Zolone (0.25 kg a.i/ha) registered the minimum incidence of white ears in the reproductive phase.

Table E.6. Effect of foliar application of new chemicals on insect control and grain yield, first crop 75-76.

| Treatment | Formulation conc. (%) | Rate of application (kg a.i/ha) | Silver shoot (%) | Grain yield (kg/ha) |
|---|---|---|---|---|
| 1. Phosvel | 34.0 | 0.50 | 2.09 | 4746 |
| 2. ,, | 34.0 | 0.25 | 1.66 | 4506 |
| 3. Dursban | 40.8 | 0.50 | 1.75 | 4634 |
| 4. ,, | 40.8 | 0.25 | 3.27 | 4267 |
| 5. [illegible]ipcin | 20.0 | 0.50 | 3.76 | 4490 |
| 6. ,, | 20.0 | 0.25 | 1.64 | 2621 |
| 7. Ekalux | 25.0 | 0.50 | 3.12 | 4363 |
| 8. ,, | 25.0 | 0.25 | 2.13 | 3803 |
| 9. Dimecron | 100.0 | 0.50 | 3.84 | 4315 |
| 10. ,, | 100.0 | 0.25 | 3.16 | 3020 |
| 11. Birlane | 24.0 | 0.50 | 3.18 | 4091 |
| 12. ,, | 24.0 | 0.25 | 3.94 | 3004 |
| 13. [illegible]bithion | 50.0 | 0.50 | 2.84 | 3596 |
| 14. ,, | 50.0 | 0.25 | 2.30 | 3532 |
| 15. Folithion | 100.0 | 0.50 | 2.47 | 3564 |
| 16. ,, | 100.0 | 0.25 | 3.54 | 3516 |
| 17. Maximum protection | | - | 4.00 | 3963 |
| 18. Unprotected control | | - | 1.28 | 2717 |
| C.D. (0.05) | | | | 1214 |

Phosvel and Fundal (0.5 kg a.i/ha) proved to be highly effective against leaf roller, the percentage of damage being respectively, 5.71 percent and 7.58 percent. At the lower dose, the former was more effective than the latter. The difference between these two chemicals at the lower dose was not significant (Table E.7). Zolone, Bidrin, Tameron and Lebaycid (0.5 kg a.i/ha) were, however, on par with the lower doses of Phosvel and Fundal in their effect on leaf roller.

Phosvel registered the highest grain yield as in the previous season, indicating that it possess a wide spectrum of activity against the major pests. Bidrin ranked second (Table E.7.).

Table E.7. Effect of foliar sprays on pest control and grain yield; second crop, 1975-76.

| Treatment | Leaf roller affected leaves (%) | | Grain yield | |
|---|---|---|---|---|
| | at 0.5 kg a.i/ha | at 0.25 kg a.i/ha | at 0.5 kg a.i/ha | at 0.25 kg ai/ha |
| 1. Phosvel | 5.74 | 8.26 | 4416 | 4166 |
| 2. Fundal | 7.58 | 12.02 | 4302 | 4121 |
| 3. Zolone | 8.73 | 15.05 | 4279 | 3623 |
| 4. Bidrin | 10.70 | 13.68 | 3691 | 4370 |
| 5. Tameron | 11.15 | 15.58 | 4076 | 3623 |
| 6. Lebaycid | 13.39 | 20.40 | 4121 | 3985 |
| 7. Sevin | 17.15 | 14.73 | 4325 | 3736 |
| 8. Knocbal | 17.10 | 15.27 | 3985 | 3668 |
| 9. Maxm. Protection | 15.08 | | 4211 | |
| 10. Unprotected control | 17.29 | | 3192 | |
| C.D.(0.05) | 5.92 | | N.S. | |

Ag. ICAR 1.8.86

Seedling root dip treatment

Effectiveness of seedling root-soak in insecticidal solutions before planting on the control of insect pests was investigated in this experiment.

A large number of chemicals were tested as seedling root-soak against late nursery application of insecticides (7 days prior to uprooting) and no nursery protection. The chemicals were:

First crop season

Seedling root dip: Birlane, Dursban, Ekalux, Fundal, Folithion, Mipcin, Nuvacron, Orthene, Phosvel, Rogor, Tameron, Vamidothion (0.02 percent solution/suspension)

Late nursery application: Birlane, Dasanit, Ekalux, Folithion, Mipcin (at 0.5 kg a.i/ha)

Second crop season:

Seedling root dip only: Ambithion, Azodrin, Birlane, Birlane-SO, Cedial, Citrolane, Basudin, Hexasulfan, Macbal, Macbal WP, Metacid, Mipcin, Nuvan, Nuvacron, Padan, Vamidothion, Dursban.

The efficacy of the chemicals against the pests was rated on the 30th day after planting.

During the first crop season, gall fly was effectively controlled by seedling root soak in 0.02 percent solution of Tameron, Orthene, Birlane and Dursban. Application of Rogor granules at 0.5 kg a.i/ha 7 days prior to uprooting of seedlings also proved to be effective against gall midge incidence in the transplanted field. Dursban, Mipcin and Rogor provided adequate protection against stem borer during the early vegetative phase.

Seedling-root-dip in Mipcin and Padan were highly effective against gall fly and stem borer in the second crop season. Nuvacron, Nuvan, Galecron, Basudin, and Macbal gave initial protection against gall midge while Citrolane provided adequate protection against stem borer and leaf roller during the early vegetative phase.

The contact toxicity of these chemicals did not last beyond 30 days after planting.

Ag.ICAR 1.8.87

Maximum Protection trial

The magnitude of yield loss due to pests and the reaction of selected pre-release varieties to major insect pests was studied in the maximum protection experiment. The varieties were transplanted under protected and unprotected conditions. Protection consisted of seedling root dip in 0.02 percent carbofuran and application of Cytrolane granules at 1.0 kg a.i/ha at 20 days, 40 days and 60 days after transplanting.

During the first crop season, 7 varieties were screened: IET 2895, IET 2815, IET 1788, IET 2812, IET 1559, IET 1113 and IET 3359. The varieties tested in the second crop season were, IET 2815, IET 1785, IR 26, CR 94-MR 1550 and CR 57-MR 1523. Jaya was the check variety in both the seasons.

On an average of all the varieties tested, crop protection with insecticides registered an yield increase of 412 kg per ha in the first crop season. The yield differences between 'protection' and 'no protection' ranged from 67 kg per ha as in IET 1788 to 1133 kg per ha as in IET 2815. The performance of IET 2815 under unprotected condition was very poor indicating its suceptible reaction to pests, particularly gall midge at the vegetative phase and stem borer at the reproductive phase. The pre-release varieties IET 1788 and IET 1113 showed moderate resistance to most of the insect pests and produced almost the same yields under the protected and unprotected conditions (Table E.8).

The magnitude of yield increase on account of crop protection was higher during the second crop season (Table E9)

Table E.8. Production potential of pre-release varieties under protected and unprotected conditions; first crop, 1975-76.

| Variety | Grain yield (kg/ha) Protected | Unprotected | Difference (kg/ha) | Increase over no protection (%) |
|---|---|---|---|---|
| IET 2595 | 3933 | 3267 | 716 | 21.9 |
| IET 2815 | 3300 | 2167 | 1133 | 52.2 |
| IET 1788 | 3667 | 3600 | 67 | 1.8 |
| IET 2512 | 3233 | 2883 | 350 | 12.1 |
| IET 4559 | 3100 | 3017 | 83 | 2.7 |
| IET 1113 | 3117 | 2867 | 250 | 8.7 |
| IET 3859 | 2017 | 1567 | 450 | 28.7 |
| Jaya | 3900 | 3667 | 233 | 6.3 |

The varieties IET 2815, IET 1785 and IR 26 responded significantly to protection, the percentages of increase recorded by these varieties, being, respectively, 35.4, 45.4 and 41.7. Under unprotected conditions, these varieties succumbed to gall midge and stem borer at the vegetative phase. The pre-release varieties CR 94-MR 1550 and CR 57-MR 1523 were moderately tolerant to these pests and produced fairly good yields even under unprotected conditions.

Table E.9. Performance of pre-release rice varieties under protected and unprotected conditions, second crop 1975-76.

| Variety | Grain yield (kg/ha) Protected | Unprotected | Difference (kg/ha) | Increase over no protection (%) |
|---|---|---|---|---|
| 1. IET 2815 | 4400 | 3250 | 1150 | 35.4 |
| IET 1785 | 6133 | 4217 | 1916 | 45.4 |
| IR 26 | 4989 | 3150 | 1139 | 41.7 |
| CR 94-MR 1550 | 4217 | 3750 | 467 | 12.5 |
| CR 57-MR 1523 | 4633 | 4217 | 416 | 9.0 |
| Jaya | 5883 | 4567 | 1316 | 28.8 |

Ag.1.8.89.

Evaluation of granular chemicals

Five granular insecticides - Birlane, carbofuran, Dasanit, Ekalux and Paddigard - were evaluated at 0.75, 0.5 and 0.25 kg a.i/ha during the first crop season in order to study their efficacy against rice pest complex. The intensity of incidence of gall midge and stem borer was low during the season. The percentage of silver shoot per hill ranged from 0 to 1.25 percent and that of white ears ranged from 0 to 2.12. No incidence of gall midge and stem borer was observed in Dasanit (0.75 kg a.i/ha) treated plots. Paddigard at 0.75 kg a.i/ha was as effective as Dasanit in stem borer control during the reproductive phase. Carbofuran (0.05 kg a.i./ha) registered higher yields compared to the other chemicals tested probably due to its wide spectrum of activity against the pest complex.

During the second crop season, 8 granular chemicals were screened at 1.0 and 0.5 kg a.i./ha with the objective of identifying effective insecticides against rice pest complex. The percentages of incidence of silver shoot ranged from 2.8 as in Dasanit at 1.0 kg a.i./ha to 10.1 as in Sevidol. The intensity of incidence of stem borer was mild in Galecron, Dasanit and Birlane (1.0 kg a.i./ha) treated plots, the percentages being 0.6, 1.2 and 2.1, respectively. Mipcin registered the maximum yield of 4284 kg per ha while Galecron and Dasanit yielded, respectively, 3881 kg and 3868 kg of grain per hectare.

Ag.1.8.91.

Screening of newer insecticides

Pest control efficiency of some of the newer chemicals was evaluated as foliar sprays in 2 experiments during the year.

Sixteen chemicals were screened during the first crop season at the rate of 0.5 kg a.i./ha. The chemicals were:

| | | |
|---|---|---|
| Hexinphos 20 EC | Knocbal 50 WP | Orthene 75 WP |
| Bidrin 85 WSC | Lebaycid 100 EC | Tameron 60 EC |
| Birlane 5 SO | Macbal 50 WP | Vamidothion 40 EC |
| Phendal 50 EC | Macbal 20 EC | Zolone 35 EC. |
| Elsan 50 EC | Nuvan 100 EC | |
| Fundal 50 EC | Nuvacron 40 EC | |

The pressure of gall midge population was not severe enough to cause considerable yield decline and therefore no valid conclusions could be drawn on the efficacy of the chemicals against this pest. Phendal, Fundal, Macbal, Nuvacron, Tameron and Vamidothion provided ample protection to the crop against stem borer during the early vegetative phase. The toxicity of Tameron and Nuvacron lasted upto the flowering phase with the result they produced fewer number of white ears per hill compared to most of the other chemicals. Lebaycid was on par with these chemicals in its effect on stem borer at the reproductive phase. Fundal exhibited good knockdown effect on leaf roller and produced the highest grain yield in this trial.

During the second crop season, 18 chemicals were tested at 0.5 kg a.i./ha. They were:-

| | | |
|---|---|---|
| Ambithion 50 EC | Galecron 50 SP | Mipcin 20 EC |
| Azodrin 40 EC | RH 63 37 50 EC | Nuvan 100 EC |
| Birlane 5 SO | Hexasultan 35 EC | Nuvacron 40 SC |
| Cadial 50 EC | Macbal 20 EC | Padan 50 SP |
| Phendal 50 EC | Macbal 50 WP | Vamidothion 40 EC |
| Galecron 50 EC | Metacid 50 EC | Birlane 24 EC |

Among these chemicals, only Galecron showed a broad spectrum of activity against insects. It was effective against gall fly at the vegetative phase and stem borer and leaf roller at the reproductive phase. It indicates that Galecron has longer residual toxicity compared to the other chemicals tested. The other insecticides to show promise were Birlane (against gall midge and stem borer), Hexasulfan, Ambithion, Nuvan (against stem borer) and Padan (against leaf roller).

# P A T H O L O G Y

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Ag.1.1.12.1.

## Chemical control of brown spot

Helminthosporium blight (brown spot) is one of the most important diseases affecting rice in Kerala. It assumes serious proportions when rice is grown under poor fertility conditions. Most of the varieties are susceptible to this disease. In this experiment, the relative efficiency of seven chemicals on the control of leaf blight was studied. The chemicals were Hinosan, Dithane Z 78, Dithane M45, Aureofunginsol, Ziride, Cuman L and Miltox (Table M.1). Benibhog. which is highly susceptible to blight, was used as the test variety. The design of the experiment was randomised block with 4 replications.

Table M1. Grain yield as influenced by fungicides in the brown spot control trial

| Treatment | Rate of appln.(g/ml) | Grain yield (kg/ha) | Increase over unprotected control (%) |
|---|---|---|---|
| 1. Hinosan | 500 | 1797 | 20.3 |
| 2. Dithane Z 78 | 1500 | 1830 | 22.5 |
| 3. Dithane M 45 | 1500 | 1771 | 18.5 |
| 4. Aureofunginsol | 50 | 1739 | 16.4 |
| 5. Ziride | 1500 | 1781 | 19.2 |
| 6. Cuman L | 1500 | 1739 | 16.4 |
| 7. Miltox | 1500 | 1666 | 11.5 |
| 8. Unprotected control | | 1494 | |
| F (0.05) | | N.S. | |

The intensity of incidence of the pathogen was not high enough to cause serious crop loss. Therefore, the data on grain yield exhibited no statistical significance among the treatments. Nevertheless, the protected plots produced higher yields than the unprotected ones with the magnitudes of increase ranging from 11.5 percent (Miltox) to 22.5 per-cent (Dithane Z 78). Dithane Z 78 provided the maximum protection and produced the highest average yield.

Ag.1.1.12.3.

**Fungicides for blast disease control**

Blast is a serious disease prevalent in all the rice growing tracts of Kerala. In the absence of varieties with horizontal resistance to this disease, the best control measure seems to be the use of fungicides. Identification of effective fungicides, therefore, assumes importance.

In this experiment, which was laid out during the first crop season only, seven chemicals were screened at the doses specified in table M.2. The fungicides were sprayed 3 times

Table M.2. Grain yield of Pusa 2-21 as affected by fungicides

| Treatments | Rate of appln. (g/ml) | Grain yield (kg/ha) | Increase over control (%) |
|---|---|---|---|
| 1. Hinosan | 500 | 2314 | 12.06 |
| 2. Dithane Z-78 | 1500 | 3016 | 46.05 |
| 3. Dithane M-45 | 1500 | 2743 | 32.83 |
| 4. Aureofunginsol | 50 | 2081 | 0.77 |
| 5. Fytolan | 1500 | 2299 | 11.33 |
| 6. Difolatan | 600 | 2120 | 2.56 |
| 7. Cuman L | 1600 | 2377 | 15.11 |
| 8. Unprotected control | | 2065 | - |

on the crop. The first application was done soon after the expression of disease symptoms. The second and third applications were carried out at an interval of 15 days.

The test variety was Pusa 2-21.

Dithane Z 78 and Dithane M 45 provided ample protection to the crop and registered, respectively, 46.05 and 32.83 percent more grain yield than the unprotected control (Table M.2). Both these chemicals were significantly superior to the others tested. Aureofunginsol was the least effective of all against the disease.

Ag.1.1.12.7.

Fungicidal control of sheath blight

Sheath blight (caused by Rhizoctonia solani) has become a major disease of rice in recent years in Kerala. Most of the high yielding varieties are susceptible to this disease especially when they are planted close under high fertility conditions. Earlier studies have revealed that Hinosan is effective against the disease. During the current year, some of the new chemicals were screened in 2 experiments using a highly susceptible cultivar, Jyothi, as test variety.

Table M.3. Grain yield corresponding to different treatments in the sheath blight trial, first crop, 1975-76.

| Treatment | Rate of application (g or ml/ha) | Grain yield (kg/ha) |
|---|---|---|
| 1. Hinosan | 500 | 3406 |
| 2. Dithane Z-78 | 1500 | 2860 |
| 3. Dithane M-45 | 1500 | 3351 |
| 4. Aureofunginsol | 50 | 3367 |
| 5. Fytolan | 1500 | 2977 |
| 6. Difolaten | 600 | 3250 |
| 7. Ziride | 1500 | 3468 |
| 8. Unprotected control | -- | 3289 |
| F (0.05) | | N.S. |

In the first trial, which was conducted during the rainy season (first crop), the relative efficiency of 7 chemicals (Hinosan, Dithane Z-78, Dithane M-45, Aureofunginsoil, Fytolan, Ziride and Difolatan) was studied as foliar spray (Table M.3). In the second trial which was laid out during the second crop season, two new fungicides were tested alone and in combination in two methods of application (soil , soil plus foliar) against the popular chemicals, Hinosan and Ziride. Altogether, there were 8 treatments including an unprotected control (table M.4).

Table M.4. Grain yield corresponding to different treatments in the sheath blight control trial, second crop, 1975-76

| Fungicide | Rate of appln. per ha | Method of appln. | Grain yield (kg/ha) |
|---|---|---|---|
| 1. Thiram | 20 kg | soil | 2105 |
| 2. PCNB | 20 ,, | soil | 1830 |
| 3. Thiram | 20 ,,+15 kg | soil + Foliar | 1916 |
| 4. PCNB(soil) + Thiram (foliar) | 20 ,, + 1.5 kg. | Soil + Foliar | 1942 |
| 5. Thiram | 1.5 kg | Foliar | 1916 |
| 6. Hinosan | 500 ml | Foliar | 1942 |
| 7. Ziride | 1500 ml | Foliar | 1933 |
| 8. Unprotected control | -- | -- | 1882 |
| F (0.05) | | | N.S. |

Soil application of chemicals was done just before planting while foliar spraying was carried out in 3 equal instalments at an interval of 15 days commencing from the initial expression of disease symptoms by the crop.

During both the seasons, the intensity of incidence of the pathogen was not high enough to inflict serious loss in grain production. Therefore, the relative efficacy of the chemicals could not be evaluated from the data gathered (table M.4.).

## Pathology Research under the All India Co-ordinated Rice Improvement Project

Blast (Pyricularia oryzae), bacterial leaf blight (Xanthomonas oryzae) and sheath blight (Rhizoctonia solani) are the major rice diseases that take a heavy toll on production in Kerala. The most economical protection from diseases is planting of resistant varieties. Great efforts have been made, therefore, to identify varieties possessing resistance to these diseases.

### National screening nursery

One thousand two hundred and twenty-nine breeding materials received from the co-operating centres of the All India Co-ordinated Rice Improvement Project were tested in the national screening nursery during the first crop season in order to identify entries having resistance to one or more of the major diseases. Reaction of the entries to blast pathogen was studied first under upland conditions. After this initial screening, all the entries were transplanted in the wetland providing conducive field environment for incidence of diseases. Each variety was planted in 3 lines of 3 m length. Stress and level indicator varieties were also planted after every 100 entries so as to gather information on the stress of different diseases. Finally the entries were scored for reaction to diseases using the international scoring system (0 to 9 scale).

Out of the 1229 entries tested, twentyseven showed field tolerance to the major diseases. They are listed in Table M.5. They will be screened again to gather confirmatory results.

Table M.5. Entries possessing field tolerance to major diseases

| Sl. No. | Entry No. | IET No. | Designation | Disease rating score BL | BS | SHB | BLB |
|---|---|---|---|---|---|---|---|
| 1. | 6 | 2278 | C 24670 | 2 | 3 | 3 | 3 |
| 2. | 9 | 2697 | 1141 | 2 | 2 | 3 | 3 |
| 3. | 14 | 2898 | RP 19-2 | 2 | 2 | 0 | 0 |
| 4. | 41 | 3539 | R 2408 | 2 | 1 | 0 | 0 |
| 5. | 48 | 3645 | 45688 | 2 | 1 | 0 | 0 |
| 6. | 68 | 4063 | IRP 633-150-6-5-13-1 | 2 | 1 | 0 | 0 |
| 7. | 97 | 4169 | IR 1544 - IR 157 | 2 | 1 | 0 | 0 |
| 8. | 98 | 4170 | IR 1514 - RP 6781 | 2 | 1 | 0 | 0 |
| 9. | 99 | 4171 | IR 1514 - RP 6783 | 2 | 1 | 0 | 0 |
| 10. | 101 | 4172 | IR 1529 - RP 6739 | 2 | 0 | 0 | 0 |
| 11. | 102 | 4173 | IR 1529 - RP 6746 | 1 | 0 | 0 | 0 |
| 12. | 103 | 4174 | IR 1529 - RP 6793 | 2 | 1 | 0 | 0 |
| 13. | 104 | 4175 | IR 1524 - RP 6801 | 2 | 1 | 0 | 0 |
| 14. | 141 | 4389 | BK 475 | 2 | 1 | 0 | 0 |
| 15. | 264 | 4653 | UPR 82-1-7-1-2-1 | 2 | 1 | 0 | 0 |
| 16. | 308 | 4721 | 51268 | 2 | 1 | 0 | 0 |
| 17. | 325 | 4737 | CR 151-79-4153 | 2 | 1 | 3 | 0 |
| 18. | 326 | 4738 | CR 151-79-1157 | 2 | 1 | 3 | 0 |
| 19. | 327 | 4739 | CR 151-79-1162 | 2 | 1 | 3 | 0 |
| 20. | 330 | 4712 | CR 151-79-1191 | 2 | 1 | 3 | 0 |
| 21. | 588 | 4987 | IPNS 32 | 2 | 3 | 3 | 0 |
| 22. | 641 | 5037 | TR 18 | 2 | 1 | 3 | 0 |
| 23. | 663 | 5058 | RP 1017-32-2-2 | 2 | 3 | 2 | 0 |
| 24. | 664 | 5059 | RP 1017-76-2-2 | 2 | 3 | 3 | 0 |
| 25. | 1264 | 5633 | IR 2071-717-6-3-2 | 2 | 6 | 0 | 0 |
| 26. | 1269 | 5634 | IR 2071-783-3-1-3 | 2 | 3 | 0 | 2 |
| 27. | 1271 | 5639 | IR 2071-875-2-3-1 | 3 | 2 | 0 | 0 |

0, no disease; 1, very resistant; 2, resistant; 3, moderately resistant.

BL, blast; BS, brown spot; SHB, sheath blight;
BLB, bacterial leaf blight.

**International rice sheath blight nursery**

As a part of the international rice testing programme (IRTP), 124 entries were screened for sheath blight resistance during the first crop season. Simultaneously, reaction of these entries to other diseases was also tested. The experiment was planted under high fertility conditions. In

Table M.6. Reaction of selected entries to sheath blight

| Entry No. | Designation | Score (0 to 9 scale) |
|---|---|---|
| 11 | IR 1514 A - E 666 | 3 |
| 15 | IR 127-80-1 | 4 |
| 21 | IR 262-43-8 | 4 |
| 22 | IR 789-98-2 | 3 |
| 47 | IR 6-100-9 | 3 |
| 50 | IR 2070-863-1 | 3 |
| 51 | IR 2053-521-3 | 3 |
| 56 | IR 883-12 | 4 |
| 61 | IR 20 | 3 |
| 65 | IR 2053-76 | 3 |
| 69 | Ta-poo-cho-3 | 1 |
| 73 | C 4 - 63 G | 3 |
| 83 | Pankaj | 3 |
| 98 | ARC 10836 | 4 |
| 100 | IR 2053-436 | 1 |
| 105 | ARC 10696 | 4 |
| 106 | ARC 10693 | 4 |
| 107 | ARC 10618 | 3 |
| 115 | M4 | 3 |
| 116 | ARC 10699 | 3 |
| 122 | B 15 d-K7- 19-3-1 | 3 |
| 124 | Nang Payah 132 | 1 |

1, very resistant; 3, moderately resistant; 4, mildly susceptible order to induce disease, the plants were inoculated with a most virulant strain of the sheath blight pathogen at the mid tillering stage. Intensity of incidence of the disease was rated using 0 to 9 scale.

Out of the 124 varieties screened, only one showed (entry No.124) highly resistant reaction to sheath blight (Table M.6). Twentytwo entries were either resistant or tolerant. The entries 51, 69, 100 and 115 were also resistant to blast. These entries were selected for further screening under good disease pressure during the next year.

Path.9.

High yielding varieties with multiple resistance

With the objective of identifying varieties possessing resistance to all major rice diseases, a project was initiated in 1974-75. The programme included gathering of a large number of varieties and breeding materials from all available sources and testing them under field conditions after providing conducive environment for the incidence of diseases. Seven varieties (Table M.7) and cultures which showed tolerance/resistance to major diseases in the initial screening trials in USN, IRSBN, UBN and IRON were selected during the first year. These entries were tested in 1975-76 under high inoculum potential for blast, brown spot, sheath blight and stack burn. The popular cultivars Thriveni, Jaya and Jyothi were used as susceptible checks.

All the entries showed fair degree of resistance to the major diseases, blast, sheath blight and bacterial leaf blight. IET 2694, 2512 and 2713, were mildly susceptible to helminthosporium blight (brown spot) while the check varieties were fairly tolerant. The highest yield of 3653 kg/ha was produced by the early duration culture IET 2931, the increase in yield being 189 kg per ha over Thriveni, 117 kg/ha over Jaya and 695 kg/ha over Jyothi. This culture (IET 2931) showed higher productivity during 1974-75 also. The production potential of all these multiple resistant entries will be evaluated in the next year.

Table M.7. Performance of elite cultures possessing multiple resistance

| Culture/variety | | Flowering duration (days) | Disease score | | | | Grain yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | BL | BS | SHB | BLB | |
| 1. | 15591-4 | 111 | 1 | 2 | 3 | 0 | 1389 |
| 2. | 3110 | 101 | 1 | 3 | 3 | 0 | 3375 |
| 3. | IET 2691 | 108 | 1 | 2 | 3 | 0 | 1389 |
| 4. | IET 2694 | 98 | 1 | 1 | 3 | 3 | 3194 |
| 5. | IET 2512 | 118 | 1 | 4 | 3 | 0 | 2222 |
| 6. | IET 2713 | 103 | 1 | 4 | 3 | 2 | 2722 |
| 7. | IET 2931 | 77 | 1 | 3 | 3 | 1 | 3653 |
| 8. | Thriveni | 92 | 6 | 3 | 5 | 3 | 3473 |
| 9. | Jaya | 100 | 5 | 3 | 1 | 0 | 3236 |
| 10. | Jyothi | 92 | 3 | 2 | 5 | 2 | 2958 |
| | C.D(0.05) | | | | | | 841 |

BL, Blast; BS, brown spot; SHB, sheath blight;

BLB, bacterial leaf blight.

0, no disease; 1, very resistant; 2, resistant;

3, moderately resistant.

# S E E D T E S T I N G

The Seed Testing Laboratory attached to the Rice Research Station, Pattambi caters to the seed testing needs of

i) seed multiplication agencies such as State Seed Farms,

ii) seed distribution agencies like Agrl. Officers of Intensive Paddy Development Units,

iii) crops Specialists of Research Stations, and

iv) registered seed growers.

The number of seed samples tested in this laboratory during the past 10 years is given in Table R.2.

Table R.2. Number of seed samples tested in the seed testing laboratory

| Year | Paddy | Pulses | Vegetables | Oil seeds | Green manure | Misc. | Grand total | No. of samples with SG |
|---|---|---|---|---|---|---|---|---|
| 1966-67 | 386 | - | 10 | -- | 2 | 2 | 400 | 351 |
| 1967-68 | 1045 | - | 4 | -- | 5 | - | 1054 | 934 |
| 1968-69 | 1426 | 2 | 17 | -- | 3 | 2 | 1450 | 1250 |
| 1969-70 | 1499 | 2 | -- | -- | 1 | 3 | 1505 | 1206 |
| 1970-71 | 1460 | 15 | 7 | 1 | 1 | 1 | 1485 | 1267 |
| 1971-72 | 1590 | 13 | 7 | 4 | 1 | 12 | 1627 | 1379 |
| 1972-73 | 2384 | 7 | 4 | 2 | 9 | 5 | 2411 | 1989 |
| 1973-74 | 1550 | 9 | 2 | 1 | - | - | 1562 | 1367 |
| 1974-75 | 1827 | 17 | 3 | 2 | 2 | 1 | 1852 | 1434 |
| 1975-76 | 2058 | 18 | - | 15 | - | - | 2091 | 1797 |

SG = standard germination

The following new projects were initiated during the year:

1. Influence of initial moisture content on the storage life of paddy seed.
2. Monthly variation in moisture content of paddy seeds upon prolonged storage.

# P U L S E S  I M P R O V E M E N T

Cowpea occupies an important position among the grain legumes cultivated in Kerala. The average yield of this crop is miserably low owing to the shy bearing nature of the varieties / cultivated. A project was, therefore, initiated in 1974-75 in order to identify early duration varieties possessing high yield potential.

Ag.1.1.5.3.

Evaluation of cowpea varieties

Five short term cowpea varieties (New era, Pusa do fasli, Pusa phalguni, Pusa barsathi and P 118) were tested for their yield potential along with two check varieties (Calicut 78 and Kunnamkulam local) during the rainy first crop season of 1975-76. Each variety was replicated 4 times in a randomised block design. A spacing of 30 cm x 20 cm was adopted for seeding.

Table P.1. Yield potential of cowpea varieties

| Variety | Flowering duration (days) | Grain yield (kg/ha) | Rank |
|---|---|---|---|
| 1. New era | 57 | 725 | 3 |
| 2. Pusa do fasli | 41 | 461 | 6 |
| 3. Pusa barsathi | 50 | 536 | 4 |
| 4. P.118 | 48 | 926 | 2 |
| 5. Calicut 78 | 57 | 196 | 7 |
| 6. Pusa phalguni | 41 | 525 | 5 |
| 7. Kunnamkulam local | 52 | 1198 | 1 |

The flowering durations of the varieties ranged from 41 days as in Pusa do fasli and Pusa barsathi to 57 days as in New era and Calicut 78.

The check variety, Kunnamkulam local surpassed the other cultivars in yield potential. It registered a grain yield of 1198 kg per hectare, the increase in production over the next best variety, P 118, being 28.1 percent. P 118 yielded 926 kg per ha (Table P.1). These two varieties showed promise in the trials conducted during 1974-75 also.

Ag.1.1.5.5.

Breeding of new cowpea varieties

With a view to evolve a high yielding cowpea variety with good cooking quality, hybridization work was initiated during the year using Pusa do fasli, Kilinjipayar, P 118, Kunnamkulam local, New era and Pusa barsathi as parents. Seeds were collected (F1) from the following cross combinations:

Pusa do fasli x Kunnamkulam; P 118 x Kolinjipayar. Crosses involving the other parents were not successful.

Ag.1.1.1.1.

Fertilizer requirement of cowpea

Response of the popular cultivar, 'Kunnamkulam local' to graded doses of nitrogen (0, 20, 40 kg/ha), phosphorus (0, 20, 40 kg/ha) and potash (0, 10, 20 kg/ha) was investigated in this trial.

The test variety exhibited marked response to applied nitrogen and phosphorus. Application of potash tended to depress production.

Effect of nitrogen was more pronounced compared to that of phosphorus. At all the levels of phosphorus, an increase in the dose of nitrogen resulted in remarkable yield increase. The highest yield was obtained when nitrogen and phosphorus were applied at 40 kg each per hectare, the increase in yield being 62 percent over no manure control (Table P.2).

Response to applied nitrogen was to the tune of 3.6 kg of grain per kg of N at the 20 kg per ha level and 6.0 kg per kg of N at the 40 kg per ha level. Response to phosphorus was of a lower magnitude. Grain yield was 4.2 kg per kg of P at 20 kg per ha and 3.4 kg per kg of P at 40 kg per ha.

The study indicates that application of nitrogen and phosphorus is essential for higher production of cowpea in the marginal uplands.

Table P.2. Grain yield of cowpea (kg/ha) as influenced by applied nutrients.

| | | Nitrogen (kg/ha) | | | |
|---|---|---|---|---|---|
| | | 0 | 20 | 40 | Mean |
| Phosphorus (kg/ha) | 0 | 552 | 527 | 780 | 620 |
| | 20 | 603 | 695 | 814 | 704 |
| | 40 | 612 | 758 | 894 | 755 |
| Mean | | 589 | 660 | 828 | |

Ag.1.1.5.1.

Yield trial of black gram

Ten black gram varieties were evaluated during the year in order to select a high yielding variety suitable for cultivation in Kerala. These varieties were of the same flowering duration.

Unusual rains at the flowering phase affected badly the seed setting in all the varieties. Hence the general yield level was far from satisfactory. The highest yielder was NP 14. Type 21 ranked second in production. T.9 produced the lowest yield (Table P.3).

Table P.3. Yield potential of blackgram varieties

| Variety | Flowering duration (days) | Grain yield (kg/ha) |
|---|---|---|
| 1. No. 55 | 51 | 200 |
| 2. D-6-7 | 51 | 199 |
| 3. Sind kheda | 53 | 222 |
| 4. No. 4 | 51 | 189 |
| 5. Type 21 | 51 | 309 |
| 6. Nedumangad local | 57 | 239 |
| 7. NP 14 | 51 | 389 |
| 8. NP 15 | 51 | 300 |
| 9. Co 2 | 47 | 267 |
| 10. T.9 | 51 | 39 |

Ag.4.1.5.2.

Screening of greem gram varieties

In order to identify a suitable green gram variety for Kerala, an yield evaluation trial was initiated during the rainy first crop season of 1975-76 with 4 cultivars (Philippines, NP 36, Madira and NP 40). The flowering durations of these varieties ranged from 37 days (NP 36) to 45 days (Philippines). None of them showed adaptability under the rainy conditions. Torrential rains at the flowering phase adversely affected the process of seed setting and therefore, all the varieties produced poor yields.

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Table R.1. Production of rice in the Rice Research Station, Pattambi during the last 12 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 | 36.677 | 7.250 | 106.221 | 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 |
| 1974-75 | 61.804 | 50.931 | 0.899 | 113.634 | 38.680 | 152.314 |
| 1975-76 | 61.475 | 55.842 | 3.700 | 121.017 | 43.730 | 164.747 |

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