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Style for IRRN Contributors

Units of measure and styles vary from country to country. To improve communication and to speed the editorial process, the editors of the *International Rice Research Newsletter (IRRN)* request that contributors use the following style guidelines:

• Use the metric system in all papers. Avoid national units of measure (such as cavans, rai, etc.).

• Express all yields in tons per hectare (t/ha) or, with small-scale studies, in grams per pot (g/pot) or grams per row (g/row).

• Define in footnotes or legends any abbreviations or symbols used in a figure or table.

• Place the name or denotation of compounds or chemicals near the unit of measure. For example: 60 kg N/ha; not 60 kg/ha N.

• The US dollar is the standard monetary unit for the *IRRN* Data in other currencies should be converted to US$.

• Abbreviate names of standard units of measure when they follow a number. For example: 20 kg/ha.

• Express time, money, and measurement in numbers, even when the amount is less than 10. For example: 8 years; 3 kg/ha at 2-week intervals; 7%; 4 hours.

• Write out numbers below 10 except in a series containing some numbers 10 or higher and some numbers lower than 10. For example: six parts; seven tractors; four varieties. *But* There were 4 plots in India, 8 plots in Thailand, and 12 plots in Indonesia.

• Write out all numbers that start sentences. For example: Sixty insects were added to each cage; Seventy-five percent of the yield increase is attributed to fertilizer use.

• Type all contributions double-spaced.

Genetic evaluation and utilization

OVERALL PROGRESS

Secondary selection in rice

S. S. Saini, Punjab Agricultural University, Regional Rice Research Station, Kapurthala, Punjab, India

It is generally believed that further selection cannot improve the yield of varieties of self-pollinated crops such as rice that are established by single-plant selection. Even though plants might look uniform in morphological characters, physiologic and economic characters such as yield are believed to deteriorate with further selection because of such factors as progressive accumulation of spontaneous mutations in the polygenes that control yield components, expression of hidden genetic heterogeneity, natural hybridization with other uneconomic genotypes, seed mixture with low yielding varieties, accumulation of external influences that modify the genes, and retention of unsuspected genotypes within selected pure lines.

Secondary selection was followed in three high yielding varieties commonly grown in the Punjab—IR8, Jaya, and Palman 579—to check the sources of deterioration, to exploit useful mutations in the polygenes, and to improve their yields. The procedure involved selection of from 1,500 to 2,000 true-to-type single plants from transplanted crops of each variety, growing progeny of the 100 best plants, testing promising and genetically pure progeny in replicated yield trials, and multiplying the seed of the best strains to replace the old stocks.

The secondary selections of the varieties developed in the first selection cycle (1968–1974) outyielded the bulk varieties by a highly significant margin (see table). That indicates that the yield of bulk stocks might be improved by as much as 23% in IR8, 7.5% in Jaya, and 12.8% in Palman 579. Secondary selection is being continued to improve the yield potential of those and other recently released varieties and to produce breeders' seed of high genetic purity that will serve as the nucleus for foundation and certified seeds to be multiplied yearly.

Performance of secondary selections of high yielding rice varieties of the Punjab, 1974 yield trials.

Secondary selection (no.)	Yield[a] (t/ha)	Increase over bulk variety (t/ha)	(%)
	IR8		
94	7.4**	0.8	11.5
95	7.9**	1.3	19.3
99	8.2**	1.5	23.7
	6.6	–	–
	Jaya		
98	8.05**	0.6	7.5
Bulk	7.4	–	–
	Palman 579		
1	5.2**	0.5	11.0
93	5.0**	0.3	6.7
99	5.3**	0.6	12.8
Bulk	4.7	–	–

[a]** = highly significant (0.01 level).
LSD 0.05 = 0.172 t/ha; LSD 0.01 = 0.232 t/ha

Rice in Andaman and Nicobar Islands—problems and prospects

K. N. Subramanyam, associate project director, Indian Council of Agricultural Research (ICAR), ICAR Research Centre, Port Blair, India

Andaman and Nicobar Islands in the Bay of Bengal are the most isolated parts of the Indian Union. The total area of the two groups of islands is 8,293 sq km; the Andamans account for about 76% of the land area. The climate of the islands is tropical, with only 3 to 5°C annual variation in temperature. Annual rainfall is about 3,000 mm. Humidity is about 80% throughout the year. Rain comes from both southwest and northeast monsoons. The dry season, from January to April, has scanty or little rainfall. Coconut is the most important crop. Rice, grown on about 14,000 ha, is second. Most rice is grown in low-lying areas with adequate rainfall, but rice is also grown as a direct-seeded upland crop.

More than 70% of the rice area is planted to the local variety C 14-8, which matures in about 200 days. C 14-8 is transplanted from July to September and harvested about December. It yields from 1.2 to 1.5 t/ha. Farmers prefer it because it offers one or two tiller cuttings which they use as green fodder for cattle. The variety is also fairly resistant to some common diseases and insects.

Over the last decade, the local Department of Agriculture has introduced some high yielding, short-duration varieties such as IR8, Jaya, and Ratna; however, these varieties have not spread as much as desired. Realizing the vast potential of the region, ICAR has established a research center for all aspects of crop, animal, and fishery sciences. Rice productivity may be increased by 5 to 6 times the present average yield. Short-duration varieties would ensure the growing of two crops per year. Preliminary trials with many of the hybrids obtained from the All India Coordinated Rice Improvement Project have shown that an average yield of 3 to 4 t/ha per season can easily be harvested. RPA5824, RPA 5929, IET2914, IET4097, and IET4554 yielded more than 7 t/ha in 1976 varietal trials. Because the first crop was harvested under wet conditions, seeds of many of the hybrids germinated before harvest. Incorporation of seed dormancy in early maturing varieties would be of major importance.

Basic fertilizer recommendations are not yet available for rice, so recommendations for mainland regions are usually adopted (60 kg/ha of N, P_2O_5, K_2O). Alkaline intensity varies. Fertilization experiments are in progress.

Heavy rainfall and high humidity most of the year favor weed growth. About 60% of the weeds in rice fields are monocots. Hand weeding is the best control method, but it increases production costs. Herbicide experiments are in progress.

The first crop generally does not suffer from major rice pests, although stem borers, case worms, and hoppers are sporadically noticed. The second crop is subject to heavy infestation of *Leptocorisa varicornis,* which causes serious yield loss. Blast was serious in 1976. A large number of weevils and other insects infest the seeds of rice hybrids, reducing seed germination and storage value. The stand of seeds that do germinate is also reduced.

Preliminary observations indicated that dried neem leaves *Azadirachta indica* prevent damage of stored seed. While fungicides and insecticides can be of value, their large-scale use would probably be a health hazard. Therefore, a study is undertaken to determine the best method of storing grains to ensure high germination and minimum storage loss.

A hybridization program using C 14-8 and some early maturing varieties has also been initiated. Large areas remain fallow because of salinity from inundation with sea water. Identification of crops that can tolerate salinity will contribute significantly to the development of rice-based cropping systems.

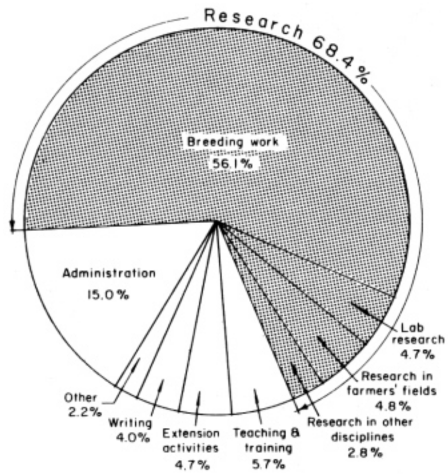
Sociological and professional characteristics of Asian rice breeders

Thomas R. Hargrove, associate editor, International Rice Research Institute

As part of an IRRI study on rice breeding programs in Asia, a survey was made of the sociological and professional characteristics of 40 rice breeders at 27 research centers in 10 Asian nations. The project was conducted in collaboration with the Agricultural Education Department, Iowa State University, USA, and was partially funded by a research grant from The Rockefeller Foundation.

The mean age of breeders was 41.9 years, ranging from 31 to 55 years. Seventy percent of the breeders were between the ages of 37 and 47. Fifty-three percent came from agricultural backgrounds (when they were growing up more than half of their family income was derived from agricultural sources). Of the latter, 95% came from families that owned their land. Fifty-five percent indicated that their families owned the land and farmed it themselves; 40% rented or sharecropped most of their land to other farmers. One respondent's family had rented land.

The mean number of years of professional experience (excluding academic work) of the rice breeders surveyed was 13.9, ranging from 2 to 33 years. Twenty-six percent had 10 years or less of experience; 28% had 20 years or more.



How rice breeders allocate their professional time among different types of work. Thirty-eight scientists at 27 experiment stations and universities in 10 Asian nations, 1975.

Eighty-five percent of the breeders indicated that they worked only with rice; 15% worked with rice and other crops, including wheat, pulses, maize, and potatoes.

To determine how scientists allocated their professional time among various activities, 38 of the breeders were asked to indicate the percentages of their time that they spent in several aspects of rice work. The mean percentages were then calculated for each activity. The breeders spent a mean percentage of 68.4% of their work time in research; 56.1% of the total time was in breeding-related activities (crossing, selecting, evaluating experimental lines, etc.) (see figure). Fifteen percent of their time went into administrative work; 5.7% went into teaching and training; 4.7% into extension; 4% into writing for publication; and 2.2% into other activities.

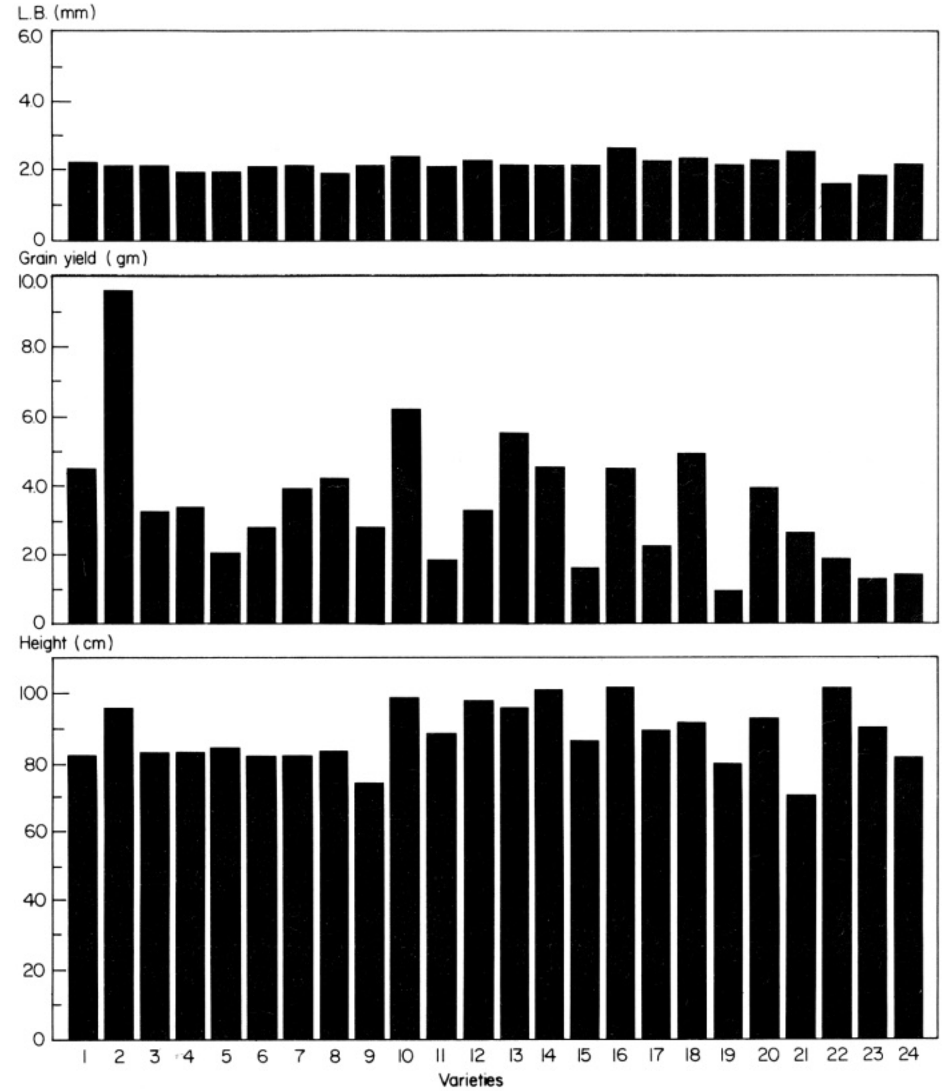
Genetic potential and utilization of rice in northeastern India

R. Garg, Botany Department, Kurukshetra University, Kurukshetra, Haryana, India

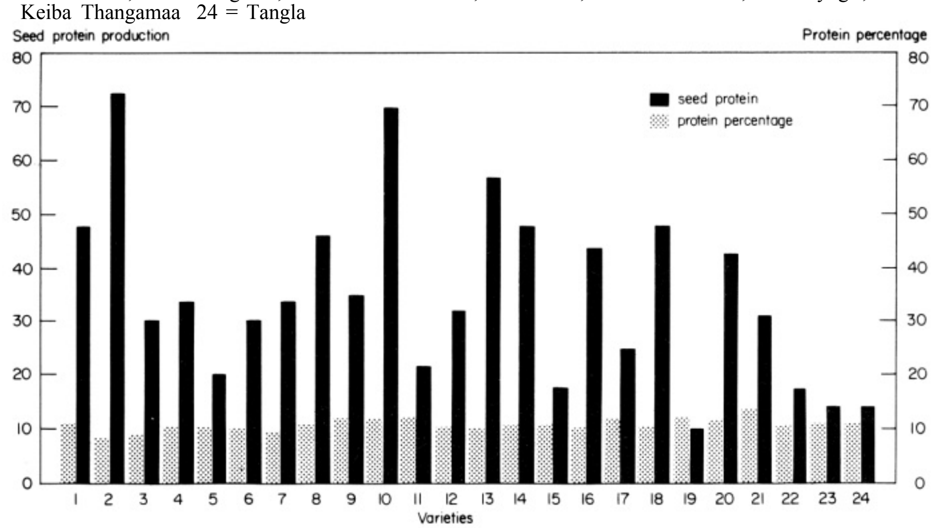
Rices grown in northeastern India were collected to determine what germ plasm is available there and its potential. The rices were grown in a randomized block at the botanical garden of North Eastern Hill University, Shillong, and the mean height, yield, grain fineness, seed protein content, and protein yield per plant were determined. Three replications of 30 plants/replication per genotype were used. The mean values computed for various traits are depicted in Figures 1 and 2. The average shoot height of the rices ranged from 71 to 102 cm. Kba Saw rut B-2, Dullo-X, and Lyngri were the tallest varieties, with shoot heights of 102, 101, and l0l cm, respectively. Theuru red was the shortest, 71 cm. Most of the rices were coarse-grained. Kba Saw rut B-2 had the finest grains and Lyngri, the coarsest.

The rices varied greatly in yield. Abar-B yielded highest followed by Ryllowhite. Local Beach-A yielded lowest. The crude seed protein content varied similarly. The highest protein level, 12.7%, was in Theuru red; the lowest, in Abar-B. But Abar-B had the best seed protein production per plant, closely followed by Ryllowhite. Fortunately, these two varieties have other desirable traits such as medium height, medium tillering, and heavy grain weight. Abar-B seems to be the best because of its high grain number per panicle, grain yield, and tiller production, along with its seed protein production. Abar-B also has high consumer preference and is well-adapted to the region's varying soil types and prevalent climatic conditions.

Furthermore, most of the inhabitants of the Northeastern Himalayan region are tribal people who are nonvegetarian, so



1. Performance of rice varieties: 1 = Abar-A, 2 = Abar-B, 3 = Abar red-A, 4 = Abar red-B, 5 = Ryllo red-1, 6 = Ryllo red-3, 7 = Ryllo red-4, 8 = Ryllo red-5, 9 = Ryllo red-6, 10 = Ryllowhite, 11 = Dullo-A, 12 = Dullo-6, 13 = Dullo-8, 14 = Dullo-X, 15 = Dullo XI, 16 = Kba Saw rut B-2,17 = Kba Saw rut B-4, 18 = Nanglwai, 19 = Local Beach-A, 20 = Kuki, 21 = Theuru red, 22 = Lyngri, 23 = Keiba Thangamaa 24 = Tangla



2. Seed protein content and production. Kurukshetra University, India. (For names of varieties, see caption of Figure 1.)

Abar-B's comparatively lower seed protein would not be detrimental to growth and development. Thus Abar-B can safely be recommended for extensive cultivation and large-scale consumption in this region.

Intan – a blast-resistant semidwarf rice for Karnataka, India

M. Mahadevappa and N. Shivanandappa, P. C. Ravi, Regional Research Station, Mandya, Karnataka, India

Intan was an experimental line from Indonesia in a set of more than 1,000 rices screened for blast resistance at the Agricultural Research Station, Ponnampet, by scientists of the University of Agricultural Sciences in collaboration with the All-India Coordinated Rice Improvement Project and IRRI. In the kharif seasons of 1969 and 1970, Intan emerged as resistant to blast. Its other special features included intermediate height, improved plant type, late maturity, and fine grain quality. It was tested in the state coordination multilocation variety trials from 1971 to 1973 at Ponnampet, Mercara, Sirsi, and Mugad and on a private farm at Mudigere where no paddy could thrive due to severe blast. Intan was compared with popular local varieties KB 356, BKB, T141, Y 4, Puttabhatha, and the new varieties IR8, IR20, Pankaj, Jagannath, Mahsuri, Vijaya, and Manohansali. Not only was the resistance of Intan confirmed, it also yielded from 20 to 30% higher than the others. The yield increase was enormous in situations where blast was severe.

District trials were conducted in farmers' fields during 1973 in 0.4-ha (1-acre) plots to compare Intan with varieties such as KB 356, Puttabhatha, IE 20, S 701, Jaya, Hanagal Rajohog, and S 1092. The yield increase ranged from 4 to 37%, averaging 20%, even under submanagement situations. In 1974 and 1975, Intan yielded as high as 7.5 t/ha.

In 1975 the State Variety Evaluation Committee released Intan for commercial cultivation in the valleys of the hilly region. In 1977 the Committee recommended it for cultivation in the lowlands of the direct-seeded tract. More than 12 ha of Intan were drill-sown in paddy block demonstrations organized by the State Department of Agriculture in Hassan District and were a great success.

Intan is photosensitive and grows to 100–125 cm in plains or hills. It grows fairly tall in coastal climate. The stems and leaves have purple pigmentation, which varies in intensity with altitude and season. The panicle is dense and partially droopy, bearing medium-slender, apiculus, and pigmented grains. It matures in 160–175 days. The CFTRI, Mysore, has reported that this rice is ideally suited for parboiling. Other reported merits are suitability to waterlogged conditions; good performance even under low fertility levels; higher brown rice recovery and grain storage quality; less milling breakage; and tolerance to short-duration floods.

Intan has been well accepted by farmers in the hilly and direct-seeded regions of Karnataka. A successful ratoon crop was raised, producing about 2 t/ha with no fertilizers and with limited seepage water, at the Agricultural Research Station, Mercara. Some farmers have also reported ratooning Intan. The variety is capable of replacing any lowland late-maturing type and is ideally suited for blast-endemic areas. Even in the plains of Mysore and Hassan districts, Intan has replaced late local types such as S 1092 and S 749 and is spreading fast.

Comparison of farmers' conditions, scientists' breeding efforts, and latest varieties

T. R. Hargrove, associate editor, International Rice Research Institute

IRRI attempted to obtain a measure of the relevance of scientists' research efforts in providing the types of varieties that farmers need in a study of rice breeding programs conducted in collaboration with Iowa State University, USA, and partially funded by the Rockefeller Foundation.

Each of 23 rice breeders at 22 experiment stations and universities in 8 Asian countries was asked 3 questions:

1) What percentage of the rice grown in farmers' fields within the area served by that experiment station was irrigated, rainfed lowland. upland, and deep-water or floating rice?

2) What percentage of the scientist's professional time was spent in improvement of irrigated, rainfed lowland, upland, and deep-water or floating rice?

3) What percentage of all varieties released by that station over the past 5 years was suited for each of the 4 rice-growing conditions? To eliminate bias, the sequence of the three questions was dispersed among other questions in the survey.

The breeders perceived a mean of 43% of the rice grown on farmers' fields as irrigated. They spent a mean of 60% of their time working on irrigated rice and considered 57% of all varieties released by their stations over the previous 5 years as suitable for irrigated conditions (see table). Although 40% of the farmers' fields were cited as rainfed lowland, the scientists spent 22% of their time in that area and considered 32% of the recently released varieties suitable for rainfed conditions. Upland rice occupied

Rice breeders' perceptions of the rice-growing conditions in farmers' fields in the regions served by experiment stations, the mean percentages of research efforts that rice breeders devote to rices for those conditions, and the varieties released over the past 5 years. Twenty-three rice breeders for 23 regions served by 22 agricultural experiment stations and universities in 8 Asian nations, 1975.

Item	Rice-growing condition (%)			
	Irrigated	Rainfed lowland	Upland	Deep-water or floating
Farmers' fields	43	40	12	5
Scientists' research efforts	60	22	14	4
Newest varieties [a]	57	32	10	2

[a] Released over the past 5 years

12% of farmers' fields, scientists devoted 14% of their time to it, and 10% of the recently released varieties were suitable for upland conditions. For deep-water and floating rice, the mean percentages were: farmers' conditions, 5%; scientists' time, 4%; and latest varieties, 2%.

Two promising IRYN cultures

S. Sevugaperumal, B. Premkumar, and Wilfred Manuel, Paddy Experiment Station, Aduthurai, India (adapted from an article in the Aduthurai Reporter, March 1977)

During September 1976, 29 medium-duration cultures of the International Rice Yield Nursery (IRYN) and check varieties IR8, IR26, and IR20 were received for tests at Aduthurai through the International Rice Testing Program. The materials were sown on 29 September and transplanted on 29 October.

Performance of rices in the International Rice Yield Nursery, Aduthurai, India.

Variety	Parentage	yield (t/ha)	Yield compared with that of IR20 (%)	Days to flowering	Plant ht (cm)	Panicle (no./hill)	Panicle wt (g)
IET 4094 (CR 156-5021-207)	BU 1/CR 115	9.0	178.5	95	69	8.3	1.21
P 881-19-22-12 IB-6-IB	IR22//IR930-147-8/Col. 1	8.7	173.0	103	73	4.0	1.77
IR8	Peta/DGWG	3.8	74.6	104	79	5.4	2.00
1R26	IR24/TKM 6	4.2	82.6	104	77	5.9	1.43
IR20	IR262/TKM 6	5.0	100.0	105	91	6.9	1.97
CD (P=0.05)	–	3.6	71.1	–	–	–	–

IET 4094 and P 881-19-22-12-IB-6-IB were superior to the checks, yielding 9.0 and 8.7 t/ha in 125 and 133 days, respectively. They are semidwarf cultures with long slender grain. IET 4094 was moderately resistant to stem borers and leaf folders, and susceptible to bacterial streak, helminthosporium, and bacterial blight diseases. P 881 was resistant to stem borers; moderately resistant to leaf folders, bacterial blight, and helminthosporium; and susceptible to bacterial streak.

GENETIC EVALUATION & UTILIZATION

Disease resistance

Experimental induction of rice tungro virus epiphytotic

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A field technique to screen rice against tungro virus has been developed at the Central Rice Research Institute, Cuttack, Orissa, India. The technique is based on the transitory virus transmission, rapid buildup, and quick movement of the vectors.

Plants were successfully infected under field conditions by manipulating the vector population, introducing a source of virus inoculum, and planting susceptible rices. Sowing and transplanting of rice were timed to coincide with the natural buildup of leafhoppers. To attract vectors to the experimental plots, planting was delayed from 4 to 6 weeks. Two rows of Taichung Native 1, which is highly susceptible to leafhoppers and tungro virus, were alternated with two test lines. A starter inoculum of as much as 1% of preinoculated seedlings of Jaya was evenly distributed. Within 30 to 40 days, 100% of the susceptible varieties were infected. Out of more than 10,000 varieties and hybrid lines screened over the past 5 years, more than 100 were identified as resistant.

Rice tungro virus disease - resistance and control

A. Anjaneyulu, Waksman Institute of Microbiology, Rutgers University, P. O. Box 759, Piscataway, N.J. 08854, USA; and G. Mohana Rao and V. D. Shukla, Central Rice Research Institute (CRRI), Cuttack, India

Tungro, one of the most devastating virus diseases of rice, occurs in epidemic form in India, the Philippines, Bangladesh, Thailand, Indonesia, and Malaysia. Losses in susceptible rices often exceed 60%. Almost 50 resistant cultivars were identified in an extensive screening program of about 5,000 tall indigenous varieties over a 4-year period at CRRI. The rices were not high yielders and were sensitive to lodging. The resistance genes are now being transferred from the donors to stiff-strawed semidwarf cultivars in an international breeding program. A few high yielding varieties, such as IR20, IR30, Pusa 2-21, Ratna, Annapurna, and Pankaj were found to be tolerant.

Tungro can also be controlled through control of its leafhopper vectors. In field and greenhouse experiments on 14 insecticides, carbofuran (Furadan 3G), at 2 kg a.i./ha at 15-day intervals, effectively controlled the disease and its vectors. Other insecticides effectively controlled the vectors, but failed to check the disease.

Screening of rice for resistance to tungro virus

R. Naik and D. Mishra, Regional Research Station, Orissa University of Agriculture and Technology, Chiplima, Orissa, India

The incidence of tungro virus disease has been high in rice planted in late August or early September in Sambalpur district, Orissa. Tungro has been observed in the area since 1972. At the Regional Research Station, 980 varieties and lines were field-screened for tungro resistance during the 1976 kharif season (Nov.). A high buildup of green leafhopper *Nephotettix virescens* coincided with high disease incidence. Twenty-nine varieties were rated as resistant and 85 as moderately resistant (see table). Tall varieties and lines that were resistant were ARC 7318, ARC 10531, ARC 13560, ARC 13820, ARC 13901, ARC 13959, ARC 7110, and Boroshungha. Semidwarf rices with resistance were lR2307-486-5-3, IR2797-125-3-2-2, RP938-27, Amol 1-82, BR 167-2B-9, BR 4 (BR 51-91-6), BR 1014 B-Pn-18-1-4, 153/54, TNAU 13610, RP 744-180-1-1-2, RP 975-109-2, 4154, CR 202-22-527, MR 292-2, and R 35-2750.

Tungro screening results in the 1976 kharif season. Orissa University of Agriculture and Technology, Orissa, India.

Source of material	Varieties and lines (no.) Total screened	Resistant	Moderately resistant
International Rice Observational Nursery	331	15	68
International Rice Tungro Nursery	183	8	7
National Screening Nursery (India)	394	6	10

Effect of *Rhyncosporium oryzae* on germination of rice

A. K. Roy, Mycology Research Section, Department of Botany and Plant Pathology, Assam Agricultural University (AA U), Jorhat-785013, India

Rhyncosporium oryzae, the cause of leaf scald, usually produces symptoms on older leaves. Manifestations of its attack on seed germination and germinating seedlings were studied at AAU, Jorhat. Seeds of six rice cultivars (see table) were surface sterilized, kept on moist filter paper in petri dishes, and sprayed with a spore suspension of the fungus (10^5 conidia/ml). The percentage of germination was reduced after 4 days of inoculation, but the differences disappeared 2 days later except in Pusa 2-21 and MR 1550-5-157. The length of the radicle was reduced in all rices except Pusa 33 and the length of the plumule was reduced in all but Monohar sali (see table).

In another test, seedlings of IR8, Monohar sali, and MR 1550-5- 157 were inoculated at 4 days after germination by the above method. Average room temperature varied from 28° to 34°C. Brownish lesions developed on the radicles of 5% of the seedlings of Monohar sali and on 2% of the IR8 and MR 1550-5-157 seedlings. It seems that *R. oryzae* does not significantly affect germination of rice seed, but may occasionally occur on radicles and cause seedlings to decay.

Effect of *R. oryzae* on seed germination and germinating seedlings of six rice varieties. Assam Agricultural University, India.

Cultivar	Germination (%)		Length of radicle (mm)		Length of plumule (mm)	
	Uninoculated	Inoculated	Uninoculated	Inoculated	Uninoculated	Inoculated
Pusa 2-21	91	94	33.9	23.9	19.2	14.5
MR 1550-5-157	90	94	18.9	11.1	5.7	3.8
IR8	94	89	40.2	35.9	15.9	13.9
Prosadbhog	99	94	27.4	21.0	12.5	8.8
Pusa 33	97	90	29.0	36.5	11.8	9.5
Monohar sali	100	95	29.3	28.2	10.1	10.1

Reaction of rice varieties to and yield losses from sheath rot

R. Mohan and C. L. Subramanian, Plant Pathology Laboratory, Agricultural College, Madurai - 625 104, Tamil Nadu, India

A field trial in 1976 determined the reactions of 16 popular rice varieties to sheath rot disease caused by *Acrocylindrium oryzae.* The varieties were spray inoculated when they were 80 days old. Control plots were maintained for each variety. The yields of both healthy and infected plants of each variety were recorded and the percentage of yield loss was determined (see table).

Reaction of rice varieties to and yield loss from sheath rot. Tamil Nadu, India.

Variety	Disease incidence (%)	Yield loss (%)
Co 39	48.6	57.4
Co 36	34.0	48.0
Karuna	31.8	39.8
Kannagi	31.4	33.4
Jaya	29.1	42.3
Vaigai	25.8	29.8
IR20	22.6	31.4
Kanchi	21.7	28.1
IR22	19.3	22.4
IR8	19.2	28.5
Ponni	17.1	17.3
IR29	15.3	21.2
IR5	14.2	24.3
Bhavani	12.7	13.9
Jagannath	3.6	6.2

Field reaction of released and prereleased rice varieties to sheath blight and leaf scald diseases

N. Mukherjee, Department of Plant Pathology, BCKV, Kalyani, Nadia, West Bengal, India

Sheath blight and leaf scald diseases of rice have been gaining importance in this locality since they were first reported from this laboratory about 8 years ago. Observations on the field reactions of some released and prereleased varieties to these diseases are presented in the table.

Reaction of rices to sheath blight and leaf scald in West Bengal, India.

Variety or line	Reaction to Sheath blight	Leaf scald
TN1	S	S
Bala	S	S
Ratna	MR	R
Padma	MR	MR
Karuna	S	S
IR8	S	S
IR20	S	MR
IR22	S	S
IR24	S	S
Jaya	S	S
IR26	MR	S
Vijaya	HS	S
Pankaj	MR	S
Jayanti	S	S
Sona	S	S
Mashuri	R	S
ADT-27	S	MR
Jagannath	S	MR
Palman-579	S	S
IET-849	MR	MR
Kumar	S	MR
Rajeswari	MR	MR
Hema	MR	S
Pusa-2-21	S	S
IR28	S	S
IR30	S	MR
IET-2914 (RP-79-14)	S	MR
Kalinga-I	MR	S
Improved Sabarmati	S	S
CR 44-35	MR	MR
CR 44-117-1	MR	S
CR 44-1 18-1	S	S
CR 44-1 19-1	HS	S
CR 44-1	S	MR
CR 110-174	HS	S
CR 115-94	MR	MR
CR 36-148	S	MR
CR 126-42-1	S	S
IR442-2-58	S	MR
IET 3233	S	MR
IET 3266	S	S
RP 633-680-1-1-1-1	MR	S
IET 2508	MR	MR
RP 4-14	R	MR

R = resistant; MR = moderately resistant; S = susceptible; HS = highly susceptible.

Widespread Occurrence of leaf sca1d and ufra diseases of rice in Assam, India

A. K. Roy, Mycology Research Section, Department of Botany and Plant Pathology, Assam Agricultural University (AAU), Jorhat- 785013, India

The diseases leaf scald (cause: *Rhyncosporium oryzae)* and ufra (cause: *Ditylenchus angustus)* occurred widely under natural conditions in the International Rice Observational Nursery raised at the AAU farm, Jorhat, in 1976. Leaf scald was observed on 247 rice varieties and lines; infection was severe on 20 of the rices, and traces of infection were observed on 55 rices (see table).

Ufra infected 11 8 of the 247 rices. Severity of infection was not rated, but Amol 1-82, BW 248-1, and B 798d-Pn-26-2-1 were heavily infected. As many as 80% of the tillers of individud hi11s of Amol 1-82 and 40% of the tillers in hills of BW 248-1 were infected. In addition to the symptoms of incomplete emergence and twisting of earheads, the spindles (earheads enclosed inside the boot leaves) produced one or two deformed branches in a few cases.

Rice varieties and lines infected with leaf scald. Assam Agricultural University, Jorhat, India.

Leaf scald infection		
	Severe	
BR 150-2B-5	IET 5 11 3 (RP 872-20-4-7-2)	B 2350-7-3-3-1
BR 167-2B-1	IET 5447 (R 27-25 11)	B 2360-6-7-1-2
BR 167-2B-3	IET 5487 (RJR 115-2681)	153/54
IET 2877 (BK 284)	IET 5518 (R 35-2740)	DJ 684D
IET 3877 (TNAU 13610)	IET 5552 (R 155-73-320)	A 6-1 0-37
IET 4823 (OR 63-242)	IET 5554 (RJR 113-251)	IR3464-217-3
IET 4835 (OR 1102)	CR 141-4000-2-192	
	Trace	
BR 166-2B-13	Amol 1-82	IR4427-51-6-3
BR 169-1-1	Macuspana A75	IR4427-119-6-1
Sein Talay	62-335	IR4427-253-5-2
IET 5105 (RP 572-68-1-1-1)	74-5461	IR4427-279-4-2
B 539b–KPJ-3-5-3-2	Kaohsiung-sen-yu 104	IR4608-6-2
B 541b-Pn-7-1-2-3	Kaohsiung-yu 974	IR46 13-54-5
B 542b-Pn-19-4-1-1	RD 7 (SPR 6726-134-2-26)	IR4625-90-2
B 599d-Pn-139-1-2	IR2307-117-2-1-2	IR4625-90-3
B 805d-Mr-16-8-3	IR2307-486-5-3	1R4707-207-3
B 1014b-Pn-1-3-1	IR2793-80-2-2	IR4816-70-1
B 1014b-Pn-18-1-4	IR2798-143-3-2	IR5257-77-1
B 1293b-Pn.24-2-1	IR2823-103-5-1	BR 4
B 1742b-Pn-22-1-2	IR4227-180-3-2	B 541b-Kn-58-5-3
B 1991-Pn-43-4-1	IR4227-289-1-3	IR2058-78-1-3-2-3
B 2360-2-9-3-4	IR4228-7-1-3	Code #14013
B 2360-6-9-5	IR4215-4-3-1	IR5491-4-8
B 2932-2-3-2-5-3	IR4422-51-1-1	IET 3331
Si2	IR4427-23-2-3	KLG 6987-133-2
Vijaya (Sel.)		

Invitation to authors

The International Rice Research Newsletter (IRRN) invites all scientists to contribute concise summaries of significant rice research for publication. Contributions should be limited to one or two paragraphs and a table, figure, or photograph. They are subject to editing and abridgement to meet space limitations. Authors will be identified by name, title, and research organization.

Insect resistance

Resistance of some rice cultivars to rice gall midge

N. Panda, A. P. Samalo, and M. M. Mahakud, Department of Entomology, Orissa University of Agriculture & Technology, Bhubaneswar, Orissa state, India

The entomology department of the Orissa University of Agriculture and Technology (OUAT) has screened rice cultivars for resistance to gall midge since 1970. During the wet seasons of 1974, 1975, and 1976, lines from several crosses of resistant donors were screened under natural infestation without insecticide protection. Two replications of the rices were planted in randomized block design. Each cultivar was grown in 4-row plots 5 m long. Jaya was used as the susceptible check. Silver shoot counts were taken at 45 days after transplanting.

Of the OUAT cultures, the OR 78 series originating from the cross OR 10-35/Ptb 21 had less than 5% incidence (see table). Gall midge incidence was moderate in OR 79-3 and OR 794-1 (OR 10-35/W 1263). In the other cultures, infestation varied from 10 to 22%.

Most of the gall midge-resistant cultures from the Central Rice Research Institute were highly resistant for 3 successive years. The donor parents, including the resistant check Sakti, also harbored very low populations of gall midge. However, the CR 138 series (progeny of the cross Jaya/TKM 6) had more than 15% infestation.

Reactions of rice cultivars to rice gall midge (mean of 1974 through 1976 wet seasons). Orissa, India.

Cultivars rated as		
Resistant[a] (0–5% infestation)	Moderately resistant (5.1–10% infestation)	Susceptible[b] (10.1–22% infestation)
	OR series	
OR 78-1-2	OR 77-7-1	OR 77-1-2
OR 78-4	OR 79-3	OR 77-1-4
OR 78-8	OR 794-1	OR 77-2-1
		OR 79-5-1
		OR 79-6
		OR 80-1-2
		OR 80-2-1
		OR 80-6
		OR 80-10
		OR 80-18
		OR 93-1
		OR 93-2
		OR 93-4
		OR 95-3
		OR 95-4
		OR 96-4
		OR 96-5
	CRRI series	
CR 56-MR-1511-IW-1020-2	CR 56-MR-1501-IW-1016-1	CR 138-928
CR 57-MR-1023-IW-1036-2	S9-36-597	CR 139-1047
CR 57-MR-1511-IW-1028-2	CR 58-MR-1538	CR 139-1001-466
CR 57-MR-1510-IW-1024-2	CR 60-MR-1620	CR 193-1047
CR 60-MR-1539-IW-1056-1		
CR 93-MR-1024-IW-1073-1		
CR 94-MR-1624-IW-1073-1		
CR 94-MR-1550-IW-1575-E8		
CR 157-22-90		
CR 157-38943-135		
CR 157-392-21-1 85		
S5-141-461		
S6-171-121		
S6-171-388		
S7-22-527		
S8-1-717		
MR1526-1038		
MR1550-1075-690		
	Donors	
RPW 6-7		
RPW 9-4		
Isworakora		
W 1263		
Leaung 152		
Ptb 10		
Ptb 18		
Ptb 21		

[a] Sakti, the resistant check, had 3.5% infestation. [b] Jaya, the susceptible check, had 22.4% infestation.

New biotype of brown planthopper in the Mekong Delta of Vietnam

Nguyen Van Huynh, University of Can Tho, Vietnam

Brown planthoppers damaged large areas of IR26, IR30, and TN73-2 (IR1561-228-3-3) early in 1977 in Tien Giang, An Giang, and Dong Thap, three provinces with the highest rice production in the Mekong Delta. To determine if they were new biotypes hoppers were field collected and tested in a glasshouse with two sets of varieties carrying genes *Bph 1* and *bph 2.*

Preliminary results showed that the brown planthopper populations damaged varieties carrying the *Bph 1* gene but did not attack varieties with the *bph 2* gene (see table). Subsequent tests were conducted to determine the host preference of nymphs and adults, nymphal survival and development, and longevity and fecundity of adults. IR32, IR36, and IR38 adversely affected the brown planthoppers. The insects showed no preference for those varieties for feeding, shelter, and oviposition. The varieties manifested antibiosis for nymphal development and longevity of adults. Additional studies are necessary on fecundity.

About 2,000 local varieties and hybrid lines in the germ plasm bank of the University of Can Tho are being screened for resistance to biotype 2.

Reaction of varieties to brown planthoppers collected in Tien Giang, Dong Thap, and An Gang provinces in the Mekong Delta of Vietnam.[a] University of Can Tho, Vietnam, Jan.–Mar 1977.

Variety	Grade of damage[b]	Nymphs that reached adult stage[c] (%)	Longevity of female[d] (days) Range	Mean
		Bph 1 gene		
IR34	MS	54 b	–	–
TN73-2	S	64 bc	2–25	8.5 c
IR26	S	88 c	2–10	7.0 c
IR30	MS	74 c	6–25	13.5 d
		bph 2 gene		
IR38	R	12 a	2– 8	4.2 a
IR32	R	22 a	2– 8	4.8 b
IR36	R	26 a	2– 6	3.4 ab
		Susceptible checks		
Mudgo	S	62 bc	2–20	9.6 cd
TN1	S	70 c	10–20	13.3 d

[a] The experiments were conducted in a glasshouse. In a column, any two means followed by a common letter are not significantly different at the 5% level.
[b] The data were recorded when all plants of the susceptible check variety were killed.
[c] Fifty insects were observed for each variety with 5 replications.
[d] Ten pairs of adults were observed for each variety with 10 replications.

GENETIC EVALUATION AND UTILIZATION

Deep water

Deep-water tour of Thailand, Burma, and India

H. D. Catling, Deep Water Rice Pest Management Project, Bangladesh; S. K. De Datta, B. S. Vergara, International Rice Research Institute;
D. HilleRisLambers and B. R. Jackson, Thai-IRRI Deep Water Rice Project, Thailand

Scientists from the IRRI deep-water rice team visited Thailand, Burma, and India in August 1977. In Thailand many deep-water rice areas that would normally be under 1 m of water were still dry and many farmers had to reseed because of drought. In Burma the rains came late and farmers in the deep-water areas were just beginning to transplant. But in Howrah, West Bengal, India, heavy rains damaged seedbeds and newly transplanted rice.

Gathering samples for an insect survey in a farmer's field in West Bengal, India, are Dr. H. D. Catling of the Bangladesh Deep-Water Rice Pest Management Project (left) and Dr. Derk HilleRisLambers of the Thai-IRRI Deep-Water Rice Project.

The Agricultural Research Institute at Yezin, Burma, has recently completed three ponds for screening deep-water rice. The International Rice Deep Water Observational Nursery (IRDWON) will be planted in these ponds. At Patna, Bihar, India, nine new ponds, constructed in 1977, are being used to test the rice germ plasm.

In Burma, farmers are increasingly

seeking alternatives to floating rice culture. Instead of growing deep-water rice, farmers in some areas are beginning to plant a regular crop of rice immediately after the water has receded.

In Howrah, West Bengal, the group visited the first trial of new deep-water lines in a farmer's field. Lines are also being screened in Bihar. The Ford Foundation supports these adaptive trials to accelerate the development and introduction of modern varieties in the deep-water areas where water levels vary and floods are common.

Observations of insect pests in deep-water rice fields (see photo) indicated the existence of an insect complex similar to that recorded in an in-depth survey in Bangladesh that has been underway since February 1977. The most important pest was the yellow stem borer *Tryporyza incertulas.* From stem borer counts conducted in the areas visited the mean percentage of infested stems in Burma was 5.3% (1 to 11% in 3 fields); in Thailand, 6% (0 to 14% in 6 fields); and in India, 9.3% (0 to 34% in 4 fields).

GENETIC EVALUATION & UTILIZATION

Drought

Seedling drought test of deepwater rice in Thailand

C. Prechachart and N. Supapoj, Klong Luang Rice Experiment Station, Thailand

Sixty-two hybrid lines and traditional deep-water rice varieties were screened for drought tolerance at the seedling stage.

Listed in the table are hybrid lines that were tolerant to deep water and promising as seedlings under drought conditions.

Drought tolerance of deep-water rices at the seedling stage, Klong Luang Rice Experiment Station, Thailand.

Selection	Stress reading [a]	Recovery reading
BKN 7022-6-2	3.0	5.0
HTA 7203-5	3.0	6.0
BKN 6986-1-2	3.0	6.0
BKN 7022-6-4	3.0	6.0
BKN 6986-108-4	3.5	4.5
HTA 72044	3.5	5.0
HTA 7204-5	3.5	5.5
BKN 7022-10-1-2	4.0	5.0
BKN 6986-59-1	4.0	5.0
BKN 6986-59-7	4.0	5.0
BKN 7022-10-16	4.0	5.5
HTA 7204-2	4.0	5.5
BKN 6986-59-11	4.0	5.5
BKN 6986-66-2	4.5	5.0
BKN 6986-136-10	4.5	5.5
BKN 6986-136-16	4.5	5.5
BKN 6986-66-3	4.5	5.5
Leb Mue Nahng 111	4.5	6.1

[a] Scale of 1–9 in Standard Evaluation System for Rice.

Pest management and control

DISEASES

Transmission of rice ragged stunt disease

K. C. Ling, E. R. Tiongco, and V. M. Aguiero, International Rice Research Institute

The occurrence of rice ragged stunt disease at IRRI led to the study of its transmission by mechanical means (rubbing and pin-prick method), through soil, and through seeds. None showed positive results.

Ragged stunt is transmitted by the brown planthopper *Nilaparvata lugens.* The brown planthoppers that were captured directly from diseased plants in the field and used to irioculate rice seedlings caused some seedlings to develop symptoms of the disease.

The planthopper's ability to transmit the disease to a susceptible line, IR3839-1, was tested by daily serial transmission after acquisition feedings of 2, 3, 4, or more days until the death of the insect. The repeated tests involved 1,625 insects and 28,753 inoculated seedlings (1,906 seedlings died before symptoms developed). About 40% of the brown planthoppers transmitted the disease.

In a single test with a small number of insects, from 14 to 76% of the planthoppers were active transmitters. Both nymphs and adults transmitted the disease. No striking differences were observed in percentage of active transmitters between female and male adults (46 vs. 42%), and between the brachypterous and macropterous forms (42 vs. 48%). After acquisition feedings of 2, 3, or 4 days, a few insects became immediately infective, while others became infective 33 days after feeding. The average latent period was 8.6 days. The insects retained infectivity after molting, indicating that the virus passage is transstadial. The highest rate of infection observed was that of 22 seedlings infected by one insect during its life span. About 33% of the infective insects infected only one seedling during their life span. The average was 4.3 infected seedlings/infective insect. The daily transmission pattern was generally intermittent. The retention period ranged from 3 to 35 days after acquisition feeding, averaging 14.6 days. The disease-transmitting days from the time that the insect became infective until its death varied from 3.2 to 100%, averaging 41.4%. As infective insects became old, they often failed to infect seedlings. The noninfective period immediately before an insect's death ranged from 0 to 30 days, averaging 7.0 days.

The transovarial passage was determined by the infectivity of the progeny of viruliferous insects. The progeny were obtained by rearing viruliferous insects on *Monochoria vaginalis,* which was assumed to be a nonhost of ragged stunt virus. The newly hatched nymphs were used to inoculate rice seedlings at daily intervals for 20 days, except when the insects died earlier. Of the 2,472 seedlings inoculated by 164 progeny of the viruliferous insects, none became infected.

Therefore, the interaction between ragged stunt virus and the brown planthopper is categorized in the persistent group without transovarial passage.

Transmission of rice grassy stunt by three biotypes of *Nilaparvata lugens*

V. M. Aguiero and K. C. Ling, International Rice Research Institute

The ability of three biotypes of the brown planthopper *Nilaparvata lugens* to transmit rice grassy stunt disease was studied through daily serial transmission to seedlings of Taichung Native 1 after acquisition feedings of 2 and 4 days. The insects of the three biotypes, differing in ability to attack rice varieties that carry different resistance genes, were supplied by the IRRI entomology department. The test involved 4,690 insects and 27,374 inoculated seedlings.

The three biotypes did not differ significantly in their ability to transmit grassy stunt, as determined by percentage of active transmitters, latent period, retention period, number of infected seedlings per insect, and percentage of disease-transmitting days (see table). All showed transstadial passage.

The biological features, such as life span, nymphal stadia, number of molts, and molting intervals, did not differ significantly among the insects of the three biotypes used for the transmission study.

Transmission of rice grassy stunt disease by three biotypes of *Nilaparvata lugens*, IRRI, 1977.

Biotype	Active transmitters (%)	Latent period (days)	Retention period (days)	Infected seedlings (no./insect)	Disease-transmitting days (%)
1	12.1	10.2	21.6	9.3	54.9
2	10.1	9.4	20.2	9.1	56.2
3	11.4	10.2	20.8	9.8	64.3
LSD (5%)	n.s.[a]	n.s.	n.s.	n.s.	n.s.

[a] Not significant.

Rice sheath rot in Peru

Alberto Jimenez S. and Carlos Panizo S., professors, Academic Department of Agricultural Science, National University Pedro Ruiz Gallo, Lambayeque, Peru

Sheath rot of rice has been reported for the first time in Peru. The disease has been found in Lambayeque state in the rice-growing areas of Chacupe and Chongoyape and in the "El Cienago" farm of the National University Pedro Ruiz Gallo. The disease affected the rice varieties Naylamp and Radin China and the pedigree line P866-F-204-1-1 from the cross IR930-31-10//F1 IR505/ Colombia 1.

The entire sheaths of the diseased plants were discolored gray to brown and the leaves yellowed. These symptoms of accelerated senescence were noticed from flowering to maturity. A brown mycelium was observed on the inner surface of the sheaths. Perithecium bodies were also found in the parenchymal tissue.

The characteristics of perithecia and ascospores suggest that the fungus belongs to the *Ophiobolus* genus. Its pathogenicity has not been tested, however.

Transmission of rice ragged stunt by biotypes of *Nilaparvata lugens*

K. C. Ling and V. M. Aguiero, International Rice Research Institute

The transmission of rice ragged stunt disease (see IRRN 5/77) by biotypes of the brown planthopper *Nilaparvata lugens* was studied through daily serial transmission to seedlings of IR3839-1 after acquisition feedings of 2 and 4 days. The three biotypes used were supplied by the IRRI entomology department. They differed in ability to attack rice varieties that carry different resistance genes. A colony of brown planthoppers that had been reared on Taichung Native 1 in the greenhouse for several years but whose ability to attack rice varieties had not been determined was also included. The test involved 985 insects and 18,477 inoculated seedlings in three replicates.

The biotypes of the brown planthopper did not differ significantly in their ability to transmit ragged stunt, as determined by percentage of active transmitters, latent period, retention period, number of infected seedlings per insect, and percentage of disease-transmitting days (see table). All showed transstadial passage.

The biological features, such as life span, nymphal stadia, and number of molts, did not differ significantly among the insects of different biotypes used for the transmission study.

Transmission of rice ragged stunt disease by biotypes of brown planthopper Nilaparvata lugens IRRI, 1977.

Biotype	Active transmitters (%)	Latent period (days)	Retention period (days)	Infected seedlings (no./insect)	Disease-transmitting days (%)
1	41.8	8.7	15.8	5.1	36.8
2	33.6	11.0	16.0	4.3	36.2
3	40.6	7.6	14.1	4.1	38.9
Undetermined	36.6	8.0	13.9	4.6	44.7
LSD (5%)	n.s.[a]	n.s.	n.s.	n.s.	n.s.

[a] Not significant.

Control of leaf blast of rice by Kasumin

M. H. Ashrafuzzaman, professor of plant pathology, Agricultural University, Mymensingh, Bangladesh; and M. A. Rob, plant protection inspector, Jessore, Bangladesh

With the introduction of high yielding varieties, blast caused by *Pyricularia oryzae* has become a minor disease in Bangladesh. But under highly favorable conditions, it is often serious.

The use of resistant varieties is undoubtedly the most economical method of disease control, but chemicals must be used until susceptible varieties are replaced. A field trial of the antibiotic Kasumin was conducted at Jessore in August 1976 during the kharif season. The variety BR 2 (Mala) was sprayed with Kasumin at 1 .1 2 kg/ha when leaf blast symptoms occurred at maximum tillering stage. Three applications were made at 7-day intervals. Twenty days after the last application, 25 leaf samples were randomly collected from a 0.83 sq-m area with and without treatment, and the percentage of leaf infection was determined.

Kasumin reduced leaf infection from 34.3% to 3.3% in the nontreated observation: 1,222 of 3,555 leaves examined were infected. In the treated samples, 130 of the 3,905 leaves examined were infected. Because of its antibiotic property, Kasumin may be preferred to other fungicides now available in Bangladesh.

Integrated control of rice pests in farmers' fields in Thailand

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An integrated program of pest control was conducted in 1976 in areas of about 0.8 – 1.92 ha in North, Northeast, Central, and South Thailand to determine yield of various rice varieties when insecticides, fungicides, and fertilizers were applied at recommended rates. Results serve as basic information for a larger integrated control program supported by a group of farmers. Materials and methods used were the same in every region: rice seeds were treated with mancozeb (3 gm/kg seed). Carbofuran was applied at 31.25 kg/ha, and MIPC W.P. at 25 g/20 liters of water. The insecticides were applied to the seedbeds to eliminate green leafhoppers *(Nephotettix* sp.), vectors of yellow orange leaf virus in regions where the disease causes severe damage.

Information from regional plots is summarized (see table). Results for the regions follow:

1. North: RD9, a nonglutinous variety, was moderately resistant (3.6% damage) to the gall midge *Puchydiplosis oryzae.* Local glutinous varieties LL and NSPT had 14.5% and 35.1% damage, respectively. Although RD9 is fertilizer

Some results from plots for integrated control of rice pests in Thailand, 1976.

Variety	Pest damage (%)[a] BLB disease	Insects	Cost (US$/ha) Chemical	Fertilizer	Cultural and labor	Yield (t/ha)	Income (US$/ha)	Net income (US$/ha)
			North: Chiengrai					
RD9*	17	GM 3.6	43.75	35.63	144	3.7	461	238
Lai Luang	30	GM 14.5	43.75	35.63	144	2.9	367	144
Lai Luang	30	GM 20.0	0.00	0.00	144	2.8	352	208
Niaw San Pahtawng*	30	GM 35.1	43.15	35.63	144	2.2	281	58
			Northeast: Khon Khan					
RD5 *	1	0	0.67	21.81	105	7.4	688	561
RD7 *	1	0	0.67	21.81	105	6.9	642	514
Khi-Tom-Yai	15	0	5.80	21.81	105	4.5	307	174
Khi-Tom-Yai	30	SB 0.5	0.67	0.00	105	3.6	241	135
			Central: Chacheongsao					
RD7*	0.5	0	5.69	23.75	157	2.3	289	102
RD9*	0.5	0	5.69	23.75	157	3.2	398	212
Khao Khao	0.5	0	5.69	23.75	157	2.9	363	176
			South: Phatalung					
BKN 6402-352	5	SB 7-10	25.94	16.72	152	2.9	294	99
NPY132*	5	SB 7-10	25.94	16.72	152	3.6	263	68
PN43*	5	SB 7-10	25.94	16.72	152	2.1	209	14
Lon Krok	5	SB 7-10	25.94	16.72	152	2.1	211	16
Khai Mod Rin	5	SB 7-10	25.94	16.72	152	1.8	178	- 17

[a] BLB = bacterial leaf blight; GM = gall midge; SB = stem borer, * = government-recommended variety.

responsive and high yielding, it is not popular with farmers. Most farmers in the region own small farms and grow glutinous rice yearly for family consumption. Few own enough land to grow RD9 for trade.

2. Northeast: RD5 and RD7 are high yielding, resistant to diseases and insects, and responsive to fertilizers. Selection of the proper rice variety, planting date, seedbed location, and pest and disease control in the seedbed gave high production and other benefits.

3. Central: yellow orange leaf disease and brown planthopper are the major problems. Carbofuran (3%) applied once in the seedbed at the rate of 3 1.25 kg/ha was effective.

4. South: The pest and disease levels were comparable in plots planted to the government-recommended varieties (BKN 6402-352, NPY 132, and PN43) and to local varieties (LK and KMR). Yields were similar, but the recommended varieties were more profitable than the local ones.

Control of rice blast by tricyclazole 75W.P.

W. H. Tsai, plant pathologist, Chia-yi Agricultural Experiment Station, Chia-yi, Taiwan

On the first crop of 1977, the systemic fungicide Tricyclazole 75 W.P. was tested for control of rice blast on the variety Taiwan 5 in the field. Two popular rice blast fungicides, Hinosan 50 E.C. and Kitazin-p 48 E.C., were used as control.

Tricyclazole 75 W.P. was applied as a soil drench at the seedling stage 1 day before transplanting by machine. The second foliar application was made at 2 days before heading. The two other fungicides were applied twice as foliar application for leaf blast control and twice more for neck blast control.

Tricyclazole 75 W.P. at the rates of 2 and 3 g/flat as a soil drench and at 0.4 kg/ha as a foliar treatment provided excellent control of leaf and neck blast, similar to that by Hinosan (see table).

Control of rice blast by Tricyclazole 75 W.P.[a], Chia-yi, Taiwan.

Treatment	Rate of flat[b] application	foliar applications[c] (no.) Leaf blast	Neck blast	Disease incidence Leaf blast (70)	Neck blast (%)	Yield (t,ha)
Tricyclazole 15 W.P.	2 g/flat	0	1	11.4 ab	1.2 a	5.1 ab
Tricyclazole 15 W.P.	3 g/flat	0	1	11.5 ab	0.7 a	5.5 a
Hinosan 50 E.C.	0	2	2	8.4 a	2.0 a	5.2 a
Kitazin-p 48 E.C.	0	2	2	20.3 b	6.1 b	4.6 bc
Untreated control	0	0	0	34.5 c	16.4 c	4.2 c

[a] Values followed by the same letter are not significantly different at the 0.05 level.
[b] At 1 day before machine transplanting, suspending fungicide in 0.5 liter of water and pouring the suspension uniformly over the soil surface of 28day-old-rice plants growing in a 28- × 58- × 3-cm transplant flat.
[c] By hand sprayer: once with tricyclazole (0.4 kg/ha) for neck blast control, twice with Hinosan (1 liter/ha) for leaf blast, and twice with Kitazin-p (1.2 liters/ha) for neck blast.

The effect of certain fungicides on rice sheath rot

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Ten fungicides were tested at 0.1 and 0.2% concentrations against *Acrocylindrium oryzae* (since revised as *Sarocladium attenuatum),* the pathogen that causes sheath rot of rice.

Both concentrations of benomyl, carbendazim, edifenphos and mancozeb M45 inhibited the growth of *A. oryzae,* but the 0.2% level was much more effective.

Pest management and control

INSECTS

Recent brown planthopper incidence and its implications in Malaysia

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Until recently only sporadic and isolated infestations of planthoppers were observed in Malaysia, although damage was sometimes rather serious. The first incidence, recorded in 1925, was an outbreak of the whitebacked planthoppal *Sogatella furcifera* species in Krian (see table). Another outbreak occurred in late 1929 in Province Wellesley and Krian. Apparently no other major infestation was noted until 1967, when the brown planthopper *Nilaparvata lugens* and *S. furcifera* seriously attacked and destroyed more than 6,000 ha of rice in Trengganu. Closely following that, hopperburn occurred in a number of rice-growing areas. Within the last few years, similar attacks were again reported, usuallv for the first time, over smaller and more isolated areas. However, no outbreaks occurred over large areas until 1977, when extensive rice fields in Tanjong Karang were attacked by the brown planthopper. Similar brown planthopper buildups, although much smaller in scale, also occurred in Perak (Langkap, Sungai Manek, Parit, and Krian), Malacca, Negri Sembilan, and Province Wellesley (see table).

The brown planthopper may soon become the major rice pest in Malaysia.

Some factors that favor its buildup are becoming more prevalent with improved cultivation practices. They include: 1) intensive cultivation of rice (e.g., double-cropping, triple-cropping, growing of 5 crops in 2 years); 2) large-scale planting of high yielding, high-tillering and nitrogen-responsive hopper-susceptible varieties such as Bahagia, Jaya, Mat Candu, and Seri Sekinchan; 3) close spacing between rice plants (e.g., 20 cm in parts of Sekinchan); 4) staggered or continuous cropping; 5) use of excessive fertilizers, particularly high rates of nitrogen; and 6) intensive and indiscriminate use of broad-spectrum insecticides.

Among the major researches currently undertaken are 1) more comprehensive studies of the biology and ecology of the planthopper under local conditions; 2) evaluation and screening for resistant varieties; 3) developing a surveillance and monitoring system to provide early detection so that appropriate and timely control measures may be taken; 4) evaluation of intensive light trapping for control; 5) investigation of cultural aspects relating to planthopper development; 6) studies of the role and optimal employment of natural enemies; and 7) investigations of the efficient and judicious use of pesticides.

Infestations of rice planthoppers observed or reported in Malaysia.

Year	Location	Planthopper	Remarks
1925	Perak (Krian)	*Sogatella* sp.	–
1929	Perak (Krian)	*Sogatella* sp.	–
	Province Wellesley	*Sogatella* sp.	–
1967	Trengganu	*Nilaparvata lugens* and *Sogatella furcifera*	More than 6,000 ha affected. Extensive and severe hopperburn
1968	Perlis	–	Hopperburn in small patches
	Kedah	–	”
	Perak	–	”
	Province Wellesley (Bukit Merah)	–	”
	Province Wellesley (Bumbong Lima)	–	”
1974	Province Wellesley (Sungai Sintok)	–	”
1975	Province Wellesley (Bumbong Lima)	*N. lugens* and *S. furcifera*	”
	Province Wellesley (Pinang Tunggal)		”
1976	Province Wellesley (Pinang Tunggal)		”
	Kedah (several localities)	–	”
	Negri Sembilan	–	”
	Selangor (Tanjong Karang)	–	”
1977	Selangor (Tanjong Karang)	*N. lugens*	Severe hopperburn in several localities. Affected area estimated to be more than 400 ha
1977	Malacca	–	General yellowing with heavy infestations
1977	Negri Sembilan	–	”
1917	Perak (Lankap)	*N. lugens*	”
1977	Perak (S. Manek, Parit, & Krian)	*N. lugens*	Heavy infestations
1977	Province Wellesley (Pinang Tunggal)	*N. lugens*	Hopperburn in small patches over an area of about 7 ha

Rapid reduction of brown planthoppers by intensive light trapping during an outbreak in Malaysia

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Light traps were observed to attract high populations of brown planthoppers (**BPH**) during a 1967 outbreak that affected about 6,000 ha of rice in Trengganu, Malaysia. Scientists then speculated that light traps might be used to control **BPH.** The **BPH** again showed strong phototropic response in a 1977 outbreak, in which about 15,000 ha was infested in Tanjong Karang. Depending on the natural infestations, as many as 92.16 million **BPH** (131 kg; 1 g = about 705 **BPH**) may be caught by 15 fluorescent lamp traps in 4% hours (1900–2330). Most insects were generally caught during the early evening hours. In one study, the catches per trap were 17,767 **BPH** from 1930 to 2030 hours, 1,531 from 2030 to 2130 hours, 4,389 from 2130 to 2230 hours, and 7,047 from 2230–2330 hours.

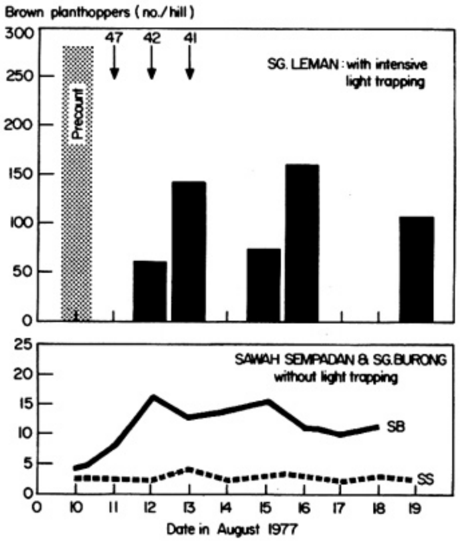
The enormous catches stimulated a study of the possibility of intensive light trapping to reduce **BPH** populations during an outbreak. In one study, 20 traps (using pressure gas lamps) were spaced around a 120-ha field from 1830 to 2300 hours. On 320 randomly selected hills (covering 32 sample points), the **BPH** population was reduced from 397 macropterous **BPH**/hill before light trapping to 156 macropterous **BPH**/hill after trapping (see table). In another study 47, 42, and 41 pressure lamp traps were used on 3 successive nights between 1900 and 2230 hours in a 100-ha field. Unlike in the earlier study, these traps were evenly spaced over the entire field.

Effect of intensive light trapping[a] on the rice brown planthopper during an outbreak in Sg. Burong, Tanjong Karang, Malaysia.

Planthopper count	Planthoppers/hill (no.)		
	Macropterous adults	Brachypterous adults	Nymphs
Before light trapping[b]	397	367	174
After light trapping	156	12	492

[a]Twenty pressure lamp traps were placed around the infested field between 1830 and 2300 hours. [b]Aug. 2, 1977.

Population counts of the BPH over 140 randomly selected hills covering 14 sample points showed that the BPH population declined drastically soon after the light trapping (see figure). The total catches for the three successive nights were 2.88, 3.42, and 4.29 million BPH, respectively. The fact that only the macropterous adults were generally caught (see table) accounted for the residual population observed in the figure.



Change in brown planthopper population in localities with intensive light trapping (Sg. Leman) and without light traps (Sawah Sempadan and Sg. Burong). Arrow and number above indicate, respectively, the night and number of light traps in operation.

For comparison, the populations of BPH were measured for the same periods at two other localities, Sawah Sempadan and Sg. Burong, where light trapping was not used. In these areas, the population was not significantly reduced (see figure).

The findings show that intensive light trapping could rapidly remove large BPH populations in an outbreak. Theoretically, one light trap/0.4 ha (1 trap/acre) might remove as many as 141 BPH/hill, or even more if the efficiency of the traps could be increased. The lowering of a BPH population before insecticide control may prove critical, as chemicals generally are not effective enough to prevent hopperburn during outbreaks.

Although intensive light trapping might play an important role, its use as the sole means of control still requires further investigation. Success seems possible only if the BPH population is composed mostly of the macropterous adults.

Outbreak of Malayan black rice bug in Nellore district

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A sudden outbreak of Malayan black rice bug *Scotinophara coarcata* was noted in the last week of May 1977 in Nellore district, Andhra Pradesh. The bug had earlier been reported to damage rice crops in other parts of India. In 150 ha of rabi paddy, infestation was severe in CO 29 and IET 2508 varieties at the time of flowering. Yield losses of from 60 to 85% were recorded. The bugs also seriously damaged almost 100 ha of IET 2508 in the transp1anted ear1y kharif crop. They seemed to prefer young seedlings; in some places, nurseries of CO 29 and IET 2508 were almost totally destroyed. Irrigation water was standing in the affected plots although the weather was mostly dry. In heavily infested plots, about 200 bugs/hill were found, mostly at the base of the plant. Surprisingly, not a single bug was found in the dry nurseries. Farmers were advised to spray dieldrin, gamma BHC, methyl parathion, malathion, or dichlorvos. Less expensive chemicals such as DDT or BHC, either as dust or spray, have been found equally effective.

Outbreak of *Heteronychus oryzae* in rice seedlings near Rokupr, Sierra Leone

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During early June 1977, an outbreak of *Heteronychus oryzae* occurred at Magbolontor, near a mangrove swamp where extensive rice experimental trials are conducted by the Rice Research Station, Rokupr.

All the experimental fields and nurseries at Magbolontor had been direct-seeded at about the end of May. At about the two-leaf stage, glossy dark-brown beetles *(Heteronychus oryzae)* began to attack the rice seedlings.

Damage to rice seedlings by *Heteronychus oryzae* at Magbolontor, Sierra Leone, 8 June 1977.

Variety	Seedling infestation (%)
2526	1.7
Huallaga	4.2
052/37	4.5
Ngovie	5.5
Bakutu	6.3
Parmatis	8.0
Gissi 27	8.1
Andy 301	9.2
ROK 4	12.8
Adny 4	29.9
Sokopent	33.8
Babadin	45.5
Gbinteh	49.5
Pa Panel	51.0
M-207	52.0
ROK 3	72.6[a]
BD 2	87.5
Mahsuri	94.5

[a]Sample unit was 1 sq m. Twenty sample units were taken in 1.4-ha seed multiplication fields, and two sample units were recorded from each plot of the other varieties for varietal observation experiments.

The insects damaged the stem below the ground by nibbling, leaving the attacked parts fibrous. The leaves withered and turned brown. The beetles then moved below the soil surface, leaving behind a raised track and damaging other seedlings. The extent of damage varied among the varieties (see table). Many of the experimental fields had to be resown.

Dieldrex 20 and Agrocide 26 DP applied at 0.085 and 0.25%, respectively, suppressed the infestation.

Surveillance profile for pest management

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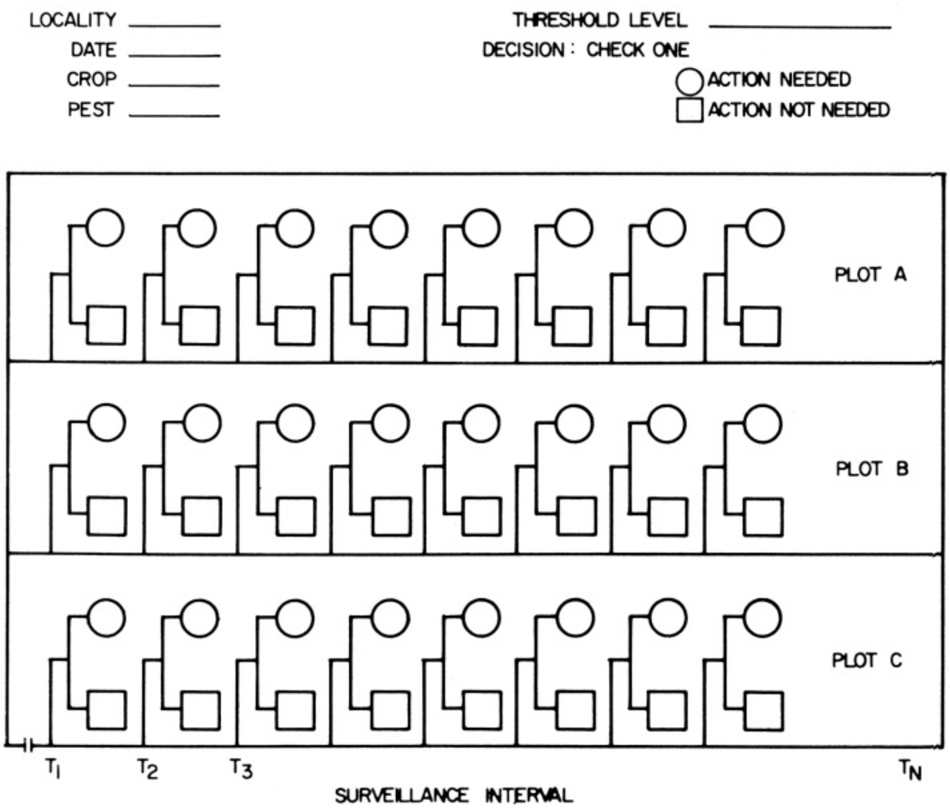
A surveillance profile for pest management consists of a series of circles and squares that are connected to surveillance dates (T_1, T_2 - - - T_n). The circle indicates "action needed," and the square, "action not needed" (see figure).

The use of this simple method begins shortly after planting the crop. To make decisions on "action needed" and "action not needed," the economic threshold level for the pest should first be known. Sampling stations or plots are then staked out at representative parts of the field. Surveillance is carried out at each station by examining a specified number of randomly selected plants. If the pest population on the plant exceeds or approaches the established threshold level on a surveillance date, a circle is checked. If it is below the threshold level, a square is checked. This procedure is carried out for each surveillance date and for each plot throughout the surveillance period.

The surveillance profile gives growers and pest management specialists a visual running account of the pest severity on a crop. The effects of insecticide treatments, cultural practices, and, in certain instances, weather changes can be evaluated. A detailed description of the surveillance profile will be published in a forthcoming issue of the FAO Plant Protection Bulletin.



A surveillance chart for recording decisions on pest management. University of Hawaii, Honolulu, Hawaii, USA.

Effects of root-dip pesticide treatments on root-knot nematode *Meloidogvne graminicola*

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Preinoculation and postinoculation root-dip treatments were tested to compare the effectiveness of insecticides and nematicides in controlling and preventing larval invasion of the nematode *M. graminicola* under upland conditions. Each chemical was used at rates of 0, 25, 50, 100, and 200 ppm.

In the postinoculation treatments, infective larvae of the nematode were first allowed to invade the roots. Dipping roots in oxamyl at 200 ppm for 12 h reduced the number of surviving endoparasites as effectively as dipping them in the same chemical at 100 ppm for 24 h. Both fensulfothion at 50 ppm for 12 or 24 h and phorate for 24 h were as effective as oxamyl at 100 ppm for 24 h.

In the preinoculation root dip, oxamyl and fensulfothion were more effective at 100 and 200 ppm and superior to phorate or DBCP. Postinoculation root-dip treatments with oxamyl or fensulfothion for 24 h were as effective as preinoculation treatments for 12 h. The order of effectiveness of the chemicals was oxamyl or fensulfothion > phorate > DBCP. Fensulfothion and oxamyl retained toxicity for 15 days after root dipping; phorate, for 10 days; and DBCP, for 5 days. Systemic chemicals such as oxamyl, phorate, or fensulfothion persisted longer in plants when used as root dip.

Soil and crop management

Azolla in Kwangtung province, People's Republic of China

A report on conversations with members of the Kwangtung Academy of Agricultural Sciences in Kwangchow, China, on May 26, 1977. *Thomas A. Lumpkin, research scholar, International Rice Research Institute and East-West Center University of Hawaii, Honolulu, Hawaii, USA*

Azolla imbricata is grown throughout the year in Kwangtung province, People's Republic of China. In western Kwangtung, rice farmers use a domesticated variety that they call Vietnam Azolla.

Rice paddies are inoculated with 3.2 t/ha of nitrogen-fixing *Azolla.* In winter and spring, when temperature is mild and the fern is free of pests, *Azolla* reaches a density of 24 t/ha. Densities are also high during summer if pesticides are used and water temperature is kept below 30°C. *Azolla* begins to die when the water temperature approaches 40°C. At the optimum temperature of 28°C, the fronds are reddish in the center and green toward the periphery.

Present research in Kwangtung province focuses on the problems of growing *Azolla* in summer. Emphasis is on application instead of basic research, and selection of cultivars is the fundamental concern. Existing cultivars were selected for tolerance for high temperature, low temperature, and insects, and for high density and rapid growth. Breeding for new cultivars is not yet possible, but is being studied in Chekiang province.

The phosphorus requirement is a major problem of *Azolla.* When phosphorus is deficient, fronds turn light yellow. Potassium and boron are usually deficient in the fields, but iron is not. Deficiency symptoms are relieved by reducing the water level so that roots can reach the soil, especially in the summer.

High temperature and insect attack also cause change in color or shape. Insects that attack *Azolla* are larvae of *Micropsectra polypedium, Nymphula tarvata,* and *Pyralis* sp. The red or white larvae of *M. polypedium* are the most destructive. Aquatic weeds found in association with *Azolla* are *Nymphaea* sp., *Pistia stratictes,* and *Eichhornia crassipes.*

Azolla is used as pig and fish feed but not for human consumption. To pigs, *Azolla* is fed fresh or in a silage mixed with corn husk and bran.

At least one national conference relating to Azolla is held annually and other conferences are conducted at the provincial and district levels. Peasants are invited to all conferences to report on their experiences with *Azolla.*

Optimum planting date for direct-seeded rice in the Sudan Gezira

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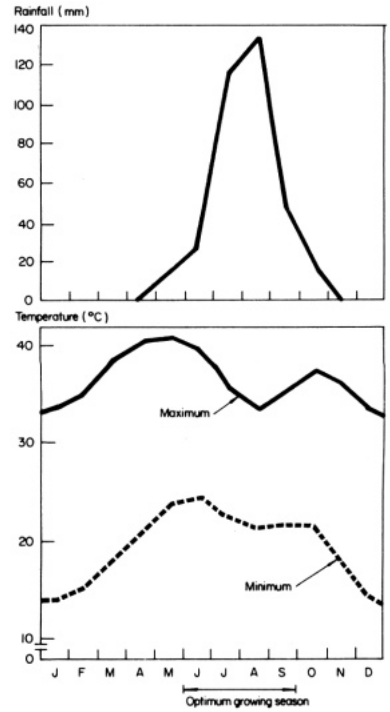
To determine the optimum planting date for direct-seeded irrigated rice in the Sudan Gezira (14°N, 33°E), six varieties of rice were selected from rice observational nurseries and planted at five dates with four replications. Grain yield and yield components were determined in a randomized complete block experiment. Cultivars planted on 1 June produced the highest grain yield (see table). Plants sown early - 15 May suffered yellowing and burning of leaf tips during the early growth stages because of high temperature and low humidity. On the other hand, cultivars sown later than 1 June were damaged by heavy rains in July and August, which caused some yield loss and nonuniform stand. In addition, low temperatures (less than 20°C) before and during panicle formation checked the growth of late-sown plants.



Temperature and rainfall distribution (av. of 30 years) at A.R.C., Wad Medani, Sudan.

The climatic conditions for rice seeded around 1 June are suitable during the entire growing season. The temperatures range from 21 to 32°C. Most of the rain falls between the maximum-tillering and panicle-formation stages; rains cease by the time plants reach maturity (see figure).

Effects of planting dates on grain yield (t/ha) of six rice cultivars grown at Wad Medani, Sudan, 1976.

Variety or line	Yield (t/ha) at various planting dates				
	May 15	June 1	June 15	July 1	July 15
IR298-12-1-1-1	3.1	4.8	3.1	2.2	1.8
IR1712-238-3	2.9	4.3	3.0	2.5	2.2
IR1514A-E597-2	3.0	4.2	3.0	3.0	2.6
IR2153-43-2-5-3	3.4	5.2	3.8	2.7	1.8
IR2153-26-3-5-2	4.0	4.5	3.7	2.3	2.7
Kuang Chu 15	2.6	4.6	3.6	2.3	2.9

Rice-based cropping systems

Potential for increased rice Production in some rainfed areas of Bangladesh

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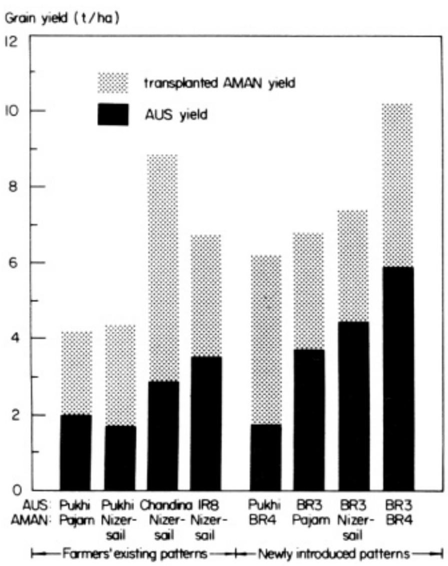
One of the most common and important rainfed cropping patterns in Bangladesh is aus rice (sown in Mar.–Apr. and harvested in July–Aug.) followed by transplanted aman rice (transplanted in July-Aug. and harvested in Nov.–Dec.). The pattern of monsoon rainfall is typically unimodal in Bangladesh. In the double-cropping system, most farmers grow two local rice varieties, but some grow one local and one high yielding variety. Farmers in some areas have recently begun to grow two crops of high yielding varieties under rainfed conditions, but average production is usually low.

Four new rice cropping patterns were designed and compared with four existing patterns under rainfed conditions in farmers' fields in the BRRI Pilot Project Area. Farmers generally applied higher management to the modern than to the local varieties, particularly in terms of fertilizer application, weeding, and insect control. The patterns were replicated in individual farmers' fields and the grain yield was determined by crop cutting. The highest yield was from two crops of modern varieties, BR3 followed by BR4 (see figure).



Annual production of eight double-cropped rice patterns under rainfed conditions, Bangladesh.

Productivity and management of farmers' aus rice crops on a rainfed double-cropped area of Bangladesh

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During the 1975 and 1976 aus seasons, crop-cut studies were conducted in farmers' fields in the BRRI project area where two crops of rainfed rice per year are grown. The first aus crop is either direct seeded or transplanted in April or May and harvested from late July to early September. It is followed by a transplanted aman crop. Samples of 5 sq m were taken from farmers' aus crops that were being harvested. Each sample was threshed, cleaned, and weighed, and moisture content was determined in the field. To ascertain the level of crop management used in each plot, each farmer was interviewed, a one-page questionnaire serving as an interview guide.

The productivity of the high yielding varieties (**HYV**) was significantly higher than that of the local varieties in both years (see table); however, variability among samples was large. The local varieties had significantly shorter growth duration than the **HYV**; that is probably the most important character influencing farmers' choice of varieties. The following transplanted aman crop must be planted as early as possible after the aus crop to maintain high yields and escape cold injury during flowering. This also explains why the long-duration, high yielding aus and aman varieties are transplanted earlier than the local short-duration aus varieties. The local photosensitive aman varieties can be transplanted later because they flower

Data on average productivity and farm management collected by crop cuts in the 1975 and 1976 aus seasons, Bangladesh Rice Research Institute.

Factor	1975		1976	
	HYV[a]	Local[b]	HYV[a]	Local[b]
Samples (no.)	40	11	73	93
Yield (t/ha)	3.6	1.8	3.1	1.6
Yield range (t/ha)	1.4–5.2	1.0–3.6	1.7–4.8	1.0–2.2
Field duration (days)	96	72	92	[89] 71[c]
Direct seeded[d]	–	–	4	80
Plowings (no.)	5.4	5.1	5.1	4.9
Harrowings (no.)	5.5	4.6	6.2	5.8
Date (seeded) transplanted	May 29	Jun 12	May 22	(Apr 24) Jun 9
Seedling age (days)	33	23	32	32
Farmers using N-P-K (%)	87-60-5	55-45-0	92-64-16	80-48-3
Rate of fertilization (kg N-P_2O_5-K_2O/ha)	51-44-20	28-38-0	53-41-34	37-46-36
Farmers that did not weed (%)	10	27	2	51
Farmers that weeded once (%)	24	64	39	53
Farmers that weeded twice (%)	46	9	54	16
Farmers that weeded thrice (%)	20	0	5	0
Farmers that used pesticide (%)	32	0	32	5
Monthly rainfall (cm)	May 35.1	Jun 22.1	May 27.4	Jun 52.1

[a]High yielding varieties (HYV) were Chandina and IR8.
[b]The local variety was Pukhi.
[c]The figure in brackets is for direct-seeded samples.
[d]Because of a late start, no direct-seeded local samples were harvested in 1975.

Announcement

When the first edition of ***Standard Evaluation System for Rice*** was printed in 1975, it was agreed that the system would be updated after several years of use. The world's rice scientists rapidly and widely adopted the standard scoring system and are now making recommendations to the International Rice Testing Program **(IRTP)** for its improvement.

The IRTP plans to print the second edition of the ***Standard Evaluation System for Rice*** during 1978. Each scientist who has used the system is encouraged to make recommendations for improving the scales of particular traits. Suggestions received by April 15, 1978 will be discussed by participants at the International Rice Research Conference in April 1978; the revised publication will be printed about June 1978.

Submit recommendations to: International Rice Testing Program, IRRI, P. O. Box 933, Manila, Philippines.

before the cold nights begin, but they yield lower because their vegetative phase is shorter. The local aus varieties are better adapted to direct seeding; farmers plant them early to extend the growing season.

Farmers generally gave higher levels of management to the HYV than to the local rices. More farmers applied higher rates of fertilizers at more balanced doses to the HYV and weeded them more often than they did the local rices. The average productivity in 1975 was about 15% higher than in 1976. The rainfall pattern during grain filling probably explains the difference.

IR26 does well as gogorancah crop in Indonesia

A. Saefuddin S. W., site coordinator; Tajuddin S., agronomist; and Anwar Hidayat, economist, Indramayu; and Suryatna Effendi, coordinator, Cropping Systems Program, Central Research Institute for Agriculture (CRIA), Indonesia

Gogorancah is the direct seeding of rice on moist aerobic soil. From 30 to 40 days after seeding, the fields are bunded and allowed to flood. Farmers along the north coastal plain of Java have extensively followed this culture for years.

Seven lowland rice varieties were tested on farmers' fields near Indramayu, West Java, to determine their yield potential when grown under gogorancah culture at the beginning of the wet season. Pelita I/1 was used as a check.

IR26 yielded the highest (5.9 t/ha), closely followed by C4-63G (5.6 t/ha) and Pelita I/l (5.2 t/ha) (see table). IR28 and other less known varieties yielded considerably less. In terms of production per day IR26 was first (47.0 kg/day) followed by C4-63G (44.6 kg/day) and IR28 (42.4 kg/day). Pelita I/1 produced only 37.2 kg/day.

IR26 appears to be very suitable for gogorancah. Farmers who use IR26 can harvest 15 days earlier and produce higher yields than those who grow Pelita I/1. Furthermore, IR26 is tolerant of the brown planthopper, a serious pest in the Indramayu area.

Varietal testing for gogorancah rice culture. Cropping systems research, Indramayu, Indonesia, 1975–76.

Variety	Maturity (DS)[a]	Plant height (cm)	Grain yield (t/ha)	Daily production (kg/ha)
IR28	105	95	4.4	42.4
B-9C	110	96	3.6	32.1
IR30	110	95	3.8	34.2
C4-63G	125	115	5.6	44.6
IR26	125	101	5.9	47.0
IR34	135	137	3.1	23.2
Pelita I/ 1	140	141	5.2	37.2

[a] Days after sowing in seedbed or direct seeding in field.

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