International Rice Research Newsletter

VOLUME 7 NUMBER 2 APRIL 1982

Published by the International Rice Research Institute, P.O. Box 933, Manila, Philippines

Contents

Guidelines and Style for IRRN Contributors

To improve communication and to speed the editorial process the editors of the International Rice Research Newsletter (IRRN) request that contributors use thefollowing guidelines and style:

Style

- 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
- When using abbrevlation other than for units of measure spell out the full name the first time of reference, with abbreviation in parenthesis, then use the abbreviation throughout the remaining text. For example: The efficiency of nitrogen (N) use was tested. Three levels of N were.... *or* Biotypes of the brown planthopper (BPH) differ within Asia. We studied the biotypes of BPH in....
- 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 intelvals; 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.

Guidelines

- Contributions to the IRRN should generally be based on results of research on rice or on cropping patterns involving rice.
- Appropriate statistical analyses are required for most data.
- Contributions should not exceed two pages of double-spaced, typewritten text. Two figures (graphs. tables, or photos) per contribution are permitted to supplement the text. The editor will return articles that exceed space limitations.
- Results of routine screening of rice cultivars are discouraged. Exceptions will be made only if screening reveals previously unreported information (for example, a new source of genetic resistance to rice pests).
- Announcements of the release of new rice varieties are encouraged.
- Use common — not trade — names for commercial chemicals and, when feasible, equipment.
- Do not include references in IRRN contributions.
- Pest surveys should be quantified with data (% infection, degree of severity, etc.).

Genetic evaluation and utilization

OVERALL PROGRESS

Performance of Indian rice varieties in Afghanistan

S. S. Saini, rice breeder, Indian Agricultural Assistance Programme, Embassy of India, Kabul, Afghanistan

The adaptability of 571 Indian varieties to local conditions was tested 1970-80. First screenings were in observational plots, initial evaluation trials, or IRTP nurseries at Baghlan in the Northern Zone, with a temperate climate, and at Jalalabad in the Eastern Zone, with a subtropical climate.

Entries which matured in time were classified as fine-grained or coarse-grained varieties. Local fine-grained varieties Barah and Pashadi and coarse-grained variety LUK were the checks. Each crop was transplanted in rows 20 cm apart with hills 15 cm apart, 2-3 seedlings/ hill. High fertility (120 kg N, 60 kg P_2O_5, and 30 kg K_2O_4 / ha) and good management practices were used.

Flowering of most varieties was delayed. Of 571 entries, only 48 (8.14%) at Baghlan and 94 (16.04%) at Jalalabad matured in time. Fourteen varieties at Baghlan and 21 at Jalalabad performed better than the local checks.

Yields of 4 fine-grained varieties at Baghlan and 12 fine-grained varieties at Jalalabad were more then the yields of the local checks (Table 1). At Baghlan, average yields of Indian varieties ranged from 5-9 t/ha to 8.8 t/ha compared to 5–6.4 t / ha for local variety Barah, a yield difference of 18-37%.

At Jalalabad, average yields of fine-grained varieties ranged from 4.1 t/ ha to 7 t/ ha compared to 2.4-5.2 t/ ha for local variety Pashadi, a yield difference of 4-135%.

CR44–11, with quality characters similar to those of Pashadi and almost double its yield potential, was released in 1975 as an improved variety for general cultivation in the Eastern Zone.

The yields of 10 coarse-grained varieties at Baghlan and 9 coarse-grained varieties at Jalalabad were more than the yield of the local check (Table 2). At

Table 1. Yields of promising fine-grained Indian rice varieties at the Agricultural Research Stations at Baghlan and Jalalabad, Afghanistan, 1970-80.

Variety	Trials (no.)	Av yield (t/ha) Indian variety	Av yield (t/ha) Local variety[a]	Increase over local variety t/ha	Increase over local variety %
		Baghlan			
RPl9-23	2	5.9	5.0	0.9	18
IET849	2	7.1	5.0	2.1	43
KC10	4	7.6	5.6	2.0	36
PuSa 33-1 8	2	8.8	6.4	2.4	38
		Jalalahad			
RPl9-23	3	6.4	4.0	2.4	58
IET849	2	5.7	5.2	0.6	11
CR44-11	18	6.3	3.2	3.2	100
CR113-91	3	4.1	3.9	0.2	4
CR44-35	2	6.8	4.2	2.6	60
ET1522	3	6.9	4.0	2.9	70
Ratna	3	6.7	2.8	3.8	135
KT1526	3	7.0	4.1	2.8	68
KC14	4	5.0	2.4	1.6	108
KC15	5	5.3	2.8	2.5	91
ET2845	2	7.0	3.2	3.8	116
ET3262	2	5.7	3.2	2.4	75

[a]Barah at Baghlan and Pashadi at Jalalabad.

Table 2. Yields of promising coarse-grained Indian rice varieties at the Agricultural Research Stations at Baghlan and Jalalabad, 1970-80.

Variety	Trials (no.)	Av yield (t/ha) Indian variety	Av yield (t/ha) Local variety (LUK)	Increase over local variety t/ha	Increase over local variety %
		Baghlan			
IET400	3	7.9	4.2	3.7	87
CR75-8	3	5.8	4.1	1.7	41
CR10-114	4	7.4	4.0	3.4	83
IET355	12	8.8	3.6	5.1	140
Padma	3	5.2	4.9	0.3	6
CR36-148	4	9.3	3.1	6.2	204
KH7194	3	10.2	3.6	5.7	180
K103-2-32	2	9.1	4.8	4.3	88
K103-2-3	2	7.4	4.8	2.6	53
K78-2	2	6.6	4.8	1.7	36
		Jalalabad			
IET400	4	6.4	3.5	2.9	82
CR75-8	6	5.0	2.8	2.3	81
CR10-114	5	6.0	3.4	2.6	77
IET355	6	5.6	3.0	2.6	84
Padma	11	7.0	2.7	4.3	158
CR36-148	4	5.7	3.8	1.9	51
Jaya	2	4.6	3.8	0.8	22
CR44-1	6	5.8	3.2	2.9	80
CR115-76	2	6.1	3.7	2.4	65

Baghlan, average yields of Indian varieties ranged from 5.2 t/ha to 10.2 t/ha compared to 3.1-4.9 t/ha for local variety LUK, a yield difference of 6-204%. At Jalalabad, average yields of Indian varieties ranged from 4.6 t/ha to 7 t/ha compared to 2.7-3.8 t/ha for the local variety, a yield difference of 22-158%.

IET355 in the Northern Zone and Padma in the Eastern Zone were released as improved varieties in 1975. KH7194 is being tested on cultivators' fields in the Northern Zone to replace IET355. No variety has been identified to replace Padma in the Eastern Zone.

Varieties with 100- to 110-day durations in India are suitable for introduction in Afghanistan. Yield levels of Indian varieties were generally higher at Baghlan than at Jalalabad, perhaps because of the better environment in the Northern Zone.

CR1009, a promising rice cultivar

P. Vivekandan, S. Kannaiyam and M. Ramachandran, Paddy Experiment Station (PES), Tirurkkuppam 602025, Tamil Nadu, India

CR1009 (IET5897), a promising long-duration rice cultivar evolved at the Central Rice Research Institute, Cuttack, is a cross between Pankaj and Jagannath. It is semidwarf, with high tillering, medium-compact panicle, and white, short, bold grains.

The performance of CR1009 and of long-duration varieties Co 25, Co 40, and NLR 9672 was tested at PES, Tirurkkuppam, during the samba season (August-January) from 1977-78 to 1980-81. CR1009 recorded a mean yield of 4.4 t/ha. Its duration was 151-165 days (Table 1).

CR1009 was also grown in farmers' fields in Thanjavur district during 1981-82 samba (Table 2).

Table 2. Performance of CR1009 in farmers' fields, Thanjavur district, India, 1981-82.

Farm size (ha)	Av grain yield (t/ha)
1.4	6.7
3.6	6.4
7.0	5.6

Table 1. Performance of CR1009 in samba season at Tamil Nadu, India.

Rice cultivar	1977-78 Yield (t/ha)	1977-78 Duration (days)	1978-79 Yield (t/ha)	1978-79 Duration (days)	1979-80 Yield (t/ha)	1979-80 Duration (days)	1980-81 Yield (t/ha)	1980-81 Duration (days)	Av Yield (tlha)	Duration (days)
CR1009	5.7	151	4.3	162	4.4	155	3.0	165	4.35	151-165
Co 25	4.5	168	2.8	162	2.8	175	2.3	178	3.10	162-178
Co 40	5.9	162	3.7	150	3.9	165	2.5	178	4.00	150-178
NLR9672	NT	NT	3.7	151	4.1	165	2.1	175	3.30	151-175
F-test	Significant		Not significant		Significant		Not significant			
C.D. ($P = 0.05$)	1.30		–		0.46		0.65			

New rice varieties for Rajasthan

R. S. Tripathi, K. B. Agrawal, and S. S. Mathur, Agriculture Research Station, Kota-324001, India

Three new rice varieties — Chambal, BK190, and BK79 — were recently named by the University of Udaipur and released for general cultivation in Rajasthan.

Chambal (IR8/NP130) is a dwarf, photoperiod-insensitive variety that matures in 135-140 days. Early seedling vigor is good and tillering ability .is moderate. It has highly synchronized flowering, late leaf senescence, and stiff straw. Grains are slightly longer than those of IR8 and protein content is higher. Average yield is 7.3 t/ha.

BK190 (R14/IR8) is an intermediate height, photoperiod-insensitive indica variety that matures in 145-155 days. Early seedling vigor is excellent and tillering capacity is good. Very sturdy tillers do not lodge even in the waterlogged fields prevalent in Bundi district. Grains are short and bold. Yield potential is 7.8 t/ha. Because of its intermediate to late duration, BK190 yields well when sown early.

BK79 (TN1/NP130//Basmati 370) matures in 124-130 days. Panicles are compact, long, and fully exserted with a slightly brown hull at the flowering stage. It has long, slender, translucent grains. BK79 yielded 56.8% more than Basmati 370 and matured nearly 15-20 days earlier. Average yield potential is 5.3 t/ha and it has high milling and head rice recovery. It was found resistant to bacterial leaf blight and green leafhoppers.

All 3 varieties have been tested for 2-3 years in minikit trials in farmers' fields.

New cultivar BPT 5204 superior to Mahsuri in India

D. Jayaraj, assistant rice specialist, Agricultural Research Institute, Rajendranagar, Hyderabad-30, Andhra Pradesh, India

Breeding programs at research stations in Andhra Pradesh are designed to select suitable cultivars to replace Mahsuri, a derivative of the cross Taichung 65/Mayangebos 80^2. Mahsuri is a weakly photoperiod-sensitive variety popular for growing during the monsoon season. Harvesting is usually in October, during the rainy season. It is a popular preference for grain quality and cooking quality. But it is medium tall and lodges even under moderate levels of nitrogen, and it lacks dormancy.

Of the crosses studied, only the progeny of GEB24/TNI//Mahsuri had grain quality similar to that of Mahsuri. GEB24 is a tall photoperiod-sensitive indica with commercial quality rice. From the large number of selections made from four cultures, BPT5656, BPT5657, BPT5322, and BPT5204 were promising. BPT5204 was found to be superior to Mahsuri (see table).

Comparable performance of new cultures and Mahsuri in Andhra Pradesh.

Culture	Effective tillers (no.)	Panicle length (cm)	Height (cm)	Yield (g/plant)
BPT5656	5	20.2	69.4	12.13
BPT5657	8	20.5	72.6	15.59
BPT5204	9	18.6	68.0	15.86
BPT5322	7	20.1	71.4	15.95
Mahsuri	4	21.5	100.0	10.30
SE	0.78	0.64	1.30	1.48
CD	1.52	1.24	2.53	2.88

The harvest index of BPT5204 was 42.5%; that of Mahsuri, only 29%. BPT5204 also has a dormancy period of 1 month.

This culture has good plant type and yield, medium slender grain with the cooking quality of Mahsuri, and dormancy. It is now in minikit programs in farmers' fields.

Two new rice varieties

R. S. Reddy and G. H. S. Reddi, Crop Breeding Research Unit, Calcutta University, West Bengal, India

Two short-duration, cold-tolerant, high-yielding rice strains suitable for agroclimatic conditions of the eastern and northeastern regions of India have been bred.

SJ-14 and SJ-15 are fine-grained strains from a cross between the widely cultivated variety Jaya and cold-conditioned Bhutan variety Soka. The new varieties are resistant to major diseases and mature in 130 days instead of the 150 days required for traditional varieties. Average yield is 5 t/ha.

GENETIC EVALUATION AND UTILIZATION

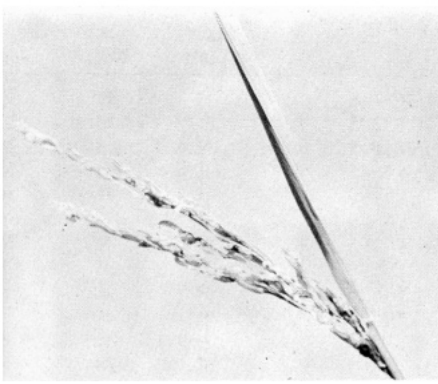
Agronomic characteristics

Panicle sterility in rice variety Sita in North Bihar, India

B. N. Singh, senior rice breeder; and Y. Prasad, assistant rice pathologist, Rajendra Agricultural University, Bihar, Pusa (Sarnastipur) 848125, India

A new type of malformation, floret abortion, in rice variety Sita leads to panicle sterility and yield loss. Symptoms were abortion of androecium and gynoecium and twisted lemma and palea in the florets. In some cases, florets were completely aborted (see figure). Sterility varied from 10 to 100% of the panicles and floret abortion varied from 5 to 90% of the panicle.

The malady was uniformly distributed



Twisted lemma and palea are symptoms of a new malformation — floret abortion — in North Bihar, India.

in the plot. Certain panicles in affected hills also suffered from sheath rot or bacterial leaf blight, but no correlation with panicle sterility could be traced. Diseased panicles sometimes set normal grains. Soil samples from affected and normal hills did not show any difference in nematode populations.

Symptoms were observed during 1980-81 and 1981-82 kharif, in different plots of the Jokhihat block, Purnea district, North Bihar.

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 pages and no more than two short tables, figures, or photographs. Contributions are subject to editing and abridgement to meet space limitations. Authors will be identified by name, title, and research organization.

GENETIC EVALUATION AND UTILIZATION

Disease resistance

Resistance to blast and brown spot in Karnataka

S. Sannegowda and K. T. Pandurangegowda, Division of Plant Pathology, Regional Research Station, University of Agricultural Sciences, Mandya 571 405 Karnataka, India

Wide distribution of blast and brown spot diseases in an epiphytotic form causes severe damage at all stages of the rice crop in many areas of Karnataka. Considerable variation in resistance to leaf blast, neck blast, and brown spot diseases occurred in 69 varieties screened during 1981 kharif. Twenty-four varieties were found resistant to leaf and neck blast disease (see table). Twenty-five varieties were found resistant to brown spot disease. Of the 69 varieties screened, only 9 showed resistance to all 3 diseases.

Resistance of released and unreleased varieties of rice to blast and brown spot in Karnataka

Variety	Disease score [a]		
	Leaf blast	Neck blast	Brown spot
IET3116	M	R	R
IET3305	R	M	M
IET3195	R	M	M
IET2685	R	M	M
IET2490	R	R	R
IET4699	R	R	M
IET4155	R	R	M
IET3280	M	M	R
IET3626	R	R	R
ET4094	R	R	R
IET1789	R	R	R
IET4107	R	M	R
IET2684	R	M	R
IET5725	R	R	R
IET2444	R	R	R
IET6211	M	R	R
IET5656	M	M	M
IET5890	R	R	M
IET5854	R	R	M
IET3629	R	M	M
IET2700	R	R	R
IET2730	M	R	M
IET4555	R	R	M
IET2570	M	M	M
IET5722	R	R	M
IET4592	R	R	M
IET5704	R	M	M
IET5721	M	M	M
IET2246	R	M	M
IET5853	M	M	M
KMP32	R	R	M
KMP41	M	R	M
KMP47	R	R	M
KMP63	M	R	M
KMP64	R	R	M
KMP65	R	M	M
KMP67	R	R	M
KMP68	R	R	M
KMP70	M	R	M
KMP73	R	R	M
KMP74	R	M	M
KMP75	R	R	M
KMP42	M	R	R
83-KMP (A) 57	R	M	M
CR222-MR-10	M	M	M
CR165-18-8	M	M	M
ES-6	M	M	M
ES-18	R	M	R
ES-24	M	M	M
IR6115-1-1-1	M	M	M
Improved Madhu	M	M	M
IR8	M	M	R
S705	M	S	R
Mahsuri	M	S	M
Intan	R	R	R
Cauvery	M	S	M
Jagnath	R	S	R
S-22	R	R	R
Madhu	R	M	M
TN1	R	M	R
Pragathi	R	M	M
MR401	M	M	R
MR362	M	R	R
MR261	R	M	R
MR343	M	M	M
Sona	R	M	R
Vani	M	R	R
ADT32	R	M	M
IR3941-8-1	R	R	M

[a] R = resistant, M = moderately susceptible, S = susceptible.

Properties and concentrations of rice bunchy stunt virus

L. H. Xie and J. Y. Lin, Fujian Agricultural College, Fujian, China

The properties of rice bunchy stunt virus (RBSV) were determined by bioassay that involves injecting a virus source into the abdomen of *Nephotettix cincticeps,* using a capillary glass needle provided by IRRI. Virus sources were prepared by homogenizing diseased materials in 0.1 M phosphate buffer solution (pH 7.0).

Infectivity of insects indicated that the dilution end point of RBSV was 10-4 of the diseased leaves and 10-3 of viruliferous insects. The thermal inactivation point was 60° C and longevity in vitro was 4 days at 0-4° C.

Ratios of infective to noninfective insects were 5:20 when they were injected with diseased leaves, 2:19 with diseased leaf sheaths, 1:21 with diseased roots, and 0:22 with diseased stems. The concentration of the virus seemed to be higher in the leaves. Injection of sap from diseased plant leaves inoculated 10 days earlier gave a ratio of 1 to 13; 20 days earlier, 2:21; 30 days earlier, 4:20; 40 days earlier, 3:19; 50 days earlier, 1:17; and 60 days earlier, 1:22.

When injected with the sap of viruliferous insects 5 days after acquisition feeding, infective insects were 0:17; 10 days after, 0:18; 15 days after, 3:20; 20 days after, 4: 12; 25 days after, 7: 15; and 30 days after, 2:5.

Tungro incidence in Bihar and West Bengal, India

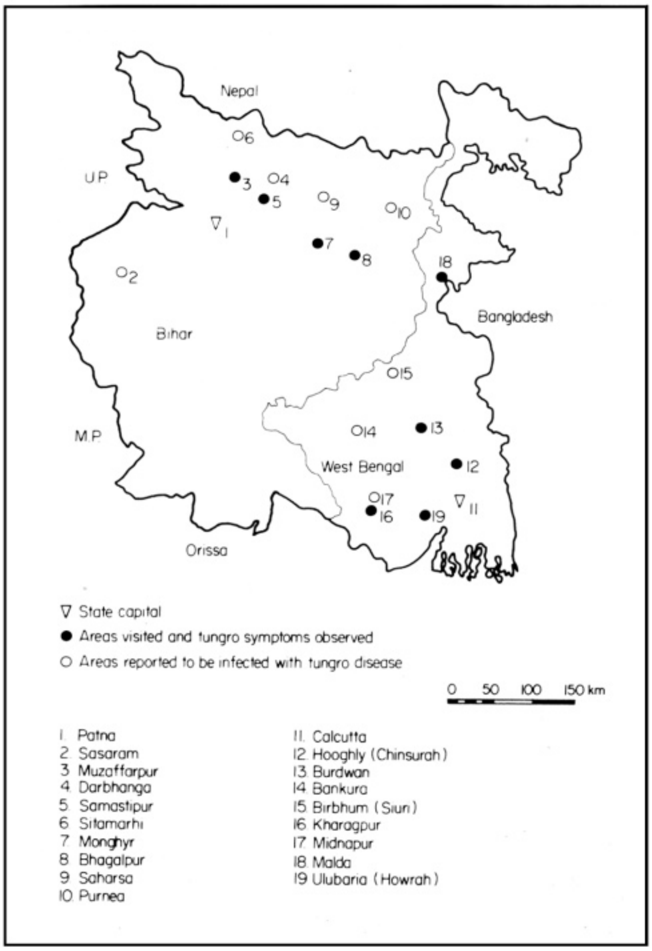
S. K. Singh M. M. Shenoi, and A. Anjaneyulu, Division of Plant Pathology, Central Rice Research Institute, Cuttack, Orissa, India

A severe incidence of tungro virus disease occurred during 1981 kharif in parts of Bihar and West Bengal (see figure). Disease incidence was 40-100% in Bihar and 60-l00% in West Bengal.

Transmission tests of samples collected from different locations were conducted to identify the virus. About 50 nonviruliferous *Nephotettix virescens* were confined on each sample for 48 hours, then on 10-day-old Taichung (Native) 1 seedlings for 24 hours. Typical symptoms of tungro virus developed within 7-10 days.

In North Bihar, the popular local variety Bakol was observed to be highly susceptible to tungro. Among the high-yielding semidwarf varieties grown in the area, Jaya, Pankaj, and Sita were susceptible; Rajendra Dhan 201 and Saket 4 were tolerant. Local improved variety BR34 was fairly tolerant. Disease incidence was higher in wetlands than in drylands.

In West Bengal, IR8, Jaya, and Mahsuri were highly susceptible to tungro. Local varieties Dorangi, Pankalash, Raghusail, and Patnai 23 were susceptible. A few local varieties — Mughi, Bismoni, Kartiksail, and Tillakachari — appeared resistant.



Tungro outbreak in Bihar and West Bengal, India, in 1981.

Rice gall dwarf virus occurrence in Peninsular Malaysia

Ong Ching Ang, Crop Protection Branch, MARDI, Serdang, Malaysia; and T. Omura, Institute for Plant Virus Research, Tsukuba Science City, Yatabe, Ibaraki 305, Japan

During a survey of rice virus disease incidence in January 1982, a number of rice plants showing characteristic symptoms of rice gall dwarf disease were observed at MARDI Rice Research Station, Bumbong Lima. The undersurface of leaf blades showed typical light green, almost round galls or vein-swellings (see figure). Infected plants were stunted, had fewer tillers, and appeared darker green than surrounding healthy plants.

A latex agglutination test used latex sensitized with antisera against rice gall dwarf virus prepared from a virus isolate from Thailand. A positive reaction showed that both viruses were serologically similar, confirming the presence of rice gall dwarf virus in Peninsular Malaysia.

Light green galls on undersurface of leaves of gall dwarf virus-infected rice plant.

Insect resistance

Whitebacked planthopper populations on rice cultivars

K. S. Kushwaha, K. K. Mrig, and Rattan Singh, Haryana Agricultural University, Rice Research Station, Kaul-132021, Kurukshetra Haryana, India

Whitebacked planthopper (WBPH) *Sogatella furcifera* (Horvath) infestations occur throughout Haryana from the first week of September to harvest. Infested fields show hopperburn patches from late September.

Sixteen medium-duration (135-140 days) rice cultivars were evaluated during 1978 kharif for reaction to WBPH. They were grown in a randomized block design at 20- × 15cm spacing replicated 4 times. Jaya was included as a susceptible check.

Populations ranged from 17 to 222 nymphs/ hill (see table). Variety RP79-8-3-2-1 had the lowest number of WBPH nymphs/hill, PR 106 had the highest. Of 16 cultivars tested, 9 developed hopperburn patches in one or more replications. Cultivars CRl2-178 and PR 106 showed high susceptibility. Local cultivar HAU4-63-3 was less susceptible than many of the cultivars tested. Resistant cultivars are now in minikit trials.

Resistance of rice cultivars to whitebacked planthopper at Kaul, India.

Variety	Cross	Nymphs/hill[a]	
		x + 0.5	Av
RP979-583-2-1-1	RPA5981/Sona	4.17 a	17.075
PAU41-356-1-5	Phulpattas 72/mut. 65	5.79 b	33.15
RP975-284-2-2	Sona/RPW6-13	6.22 bc	38.475
RP6-516-33-6-1	TKM6/IR28	6.76 cd	45.275
Jaya	TNl/T141	6.79 cd	45.875
RP6-516-29-1	TKM6/IR8	6.98 d	48.375
RP6-1899-254	TKM6/IR8	7.17 de	51.225
Sona	GEB24/TN1	8.42 ef	70.725
HAU4-63-3	IR8/Jhona 349	8.73 f	76.025
PAU41-306-1-2	Phulpattas 72/mut. 65	8.80 f	77.25
RP6-516-34-1-8	TKM6/IR8	9.55 g	90.775
UPR70-30-42	IR8/Bas 370	9.74 g	94.475
PAU32-15-2	Bas 370/IR480-5	10.13 gh	102.25
RP633-519-1-3-4	IRI/KBJ-1//IR22	10.54 h	110.725
CR12-178	IR8/CR1014	13.69 i	187.167
PR106	IR8/Peta^5//Bellepatna	14.89 i	221.625

[a]Av of 4 replications. Means followed by the same letter are not significantly different among themselves. Data transformed to x + 0.5.

Taxonomy of Asian and African rice gall midges

K. M. Harris, Commonwealth Institute of Entomology, London, UK, and R. J. Gagne, USDA Systematic Entomology Laboratory, Washington D.C., USA

It had been assumed until recently that the rice gall midge in Africa is the same species as the Asian rice gall midge *Orseolia oryzae* (Wood-Mason). Joint studies in 1981 by the Commonwealth Institute of Entomology and the USDA Systematic Entomology Laboratory of a series of reared adults with associated larvae and pupae collected by Dr. J. Etienne, ISRA-Ziguinchor, from rice in Senegal show that the African rice gall midge is a morphologically distinct species. A formal description is being prepared.

A technique for preparation of brown planthopper chromosomes

R. C. Saxena, associate entomologist, International Rice Research Institute, and senior research scientist, International Centre of Insect Physiology and Ecology, P. O. Box 30772, Nairobi, Kenya; and A. A. Barrion, graduate assistant, IRRI

Chromosome cytology has been used to determine subtle cytotaxonomic differences between related species, sibling species, subspecies, and biotypes. A simple and rapid technique for preparing meiotic chromosomes is needed to examine and compare large insect samples, especially in studies of insect systematics and evolution. A technique developed at IRRI proved useful in preparing and studying brown planthopper chromosomes. The procedure has three steps.

1. Fixing and dissecting insects — Fifth-instar nymphs and newly emerged males collected from stock cultures at 0700 h are fixed in glass vials containing Carnoy's fluid — 1 part 99.7% glacial acetic acid and 3 parts 95% ethyl alcohol — for at least 2 minutes. A fixed insect is then dissected in a drop of Ringer's solution on a clean glass slide. The head and thorax are discarded and the abdomen is dorsally incised to extract the tiny, translucent testes.
2. Staining, mounting, and labeling — The testes are submerged in a drop of 2% aceto-orcein or carmine solution for 2 minutes. With a fine-tipped, curved needle, each testis is macerated on a clean slide with a drop of 2% aceto-orcein. The cells are kept from drying out by adding a drop of 45% acetic acid. All debris are discarded.

A clean cover slip is placed over the

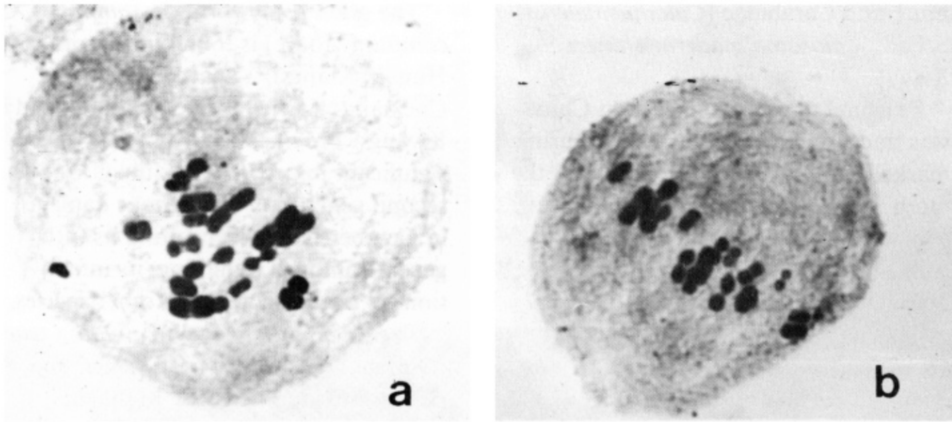
macerated testis and the testis is pressed through blotting paper to ensure adequate spread of the cells. Moderate pressure can be applied with a blunt pencil eraser to flatten the cells. The slide is examined under high magnification of a light microscope to ascertain if cells have spread and if the stain has been absorbed by cell nuclei. Extra stain can be removed by adding a few drops of 45% acetic acid on one side of the cover slip and withdrawing the excess fluid from the opposite side using an absorbent.

The preparation is passed over an alcohol lamp flame 3 to 4 times to hasten destaining and to clear the cytoplasm.

A temporary mount is maintained by sealing or ringing the cover slip with paraffin wax. For a permanent mount, the paraffin seal is carefully removed with xylene and the slide subjected to 95% alcohol for 5 minutes, 70% alcohol for 5 minutes, xylene for 5 minutes, and xylene for another 5 minutes. The cover slip is then removed and a drop of Canada balsam is put on the spot where the cover slip came. A new cover slip is placed on the preparation. The removed cover slip receives another drop of Canada balsam and is placed on the left side of the glass slide. The prepared slide is dried on a slide warmer and cleaned with xylene.

Mounted slides are labeled on the right side with specimen identification, stage of cell division, date of preparation, and worker's name.

3. Detection of M-phase — Physical and metabolic activities of growing cells are cyclic, characterized by four more or less distinct stages — Gl-, S-, G2-, and M-phases — which are regular and repetitive as long as a cell is growing and dividing. Chromosomes undergoing different meiotic stages are detected during the M-phase, which usually lasts an hour. The specific M-phase for brachypterous 5th-instar and newly emerged males of brown planthopper biotype 1 was 0700-0800 h, after which a majority of the sex cells were observed to undergo interphase or active metabolic phases (Gl-, S-, and G2-phases) (see figure).



Meiotic chromosomes of brown planthopper biotype 1 males. a. Late diakinesis or prometaphase 1 chromosomes. b. Metaphase I chromosomes in testicular cells, IRRI, 1981.

Distribution, seasonal occurrence, and natural enemies of armyworm attacking rice in China

Wu Jung-Tsung, associate professor, South China Agricultural College, Guangzhou, China

Eight noctuid species of rice armyworm belonging to two genera, *Mythimna* and *Spodoptera,* are found in China: *Mythimna separata* (Walker), *M. loreyi* (Duponchel), *M. compta* (Moore), *M. zeae* (Duponchel), *Spodoptera maurifia* Boisduval, *S. depravata* (Butler), *S. abyssinia* Guenée, and *S. pecten* Guenée. *M. separata* is the most important.

The oriental armyworm *Mythimna separata* (Walker) has been recorded from Hianan Island of Kwangtung Province to Heilungkiang Province.

South of latitude 33° N (January isotherm 0° C), *M. separata* can hibernate in winter (see table). Between 27 and 33° N, larvae generally overwinter with pupae. Sometimes they feed lightly on cereal plants, but the rate of develop ment is slow. South of 27° N (January isotherm 80° C), it infests wheat severely in winter.

Parasites and predators include Tachinidae [*Cuphocera varia* (Fabricius), *Linnaemya compta* (Fallen), *L. zachvatkini* Zimin, *Servillia planiforceps* Chao, *Siphona cristata* Fabricius, *Actia silacea* Meigen, *Exorista japonica* (Townsend), *E. fallax* Meigen, *Bessa selecta frugax* Rondani, *Carcelia excisa* (Fallen), *Drino inconspicua* Meigen, *Pales pavida* Meigen, *Pseudogonia rufifrons* (Wiedemann), *Turanogonia chinensis* (Wiedemann)], Braconidae [*Apanteles ruficrus* (Haliday), *Meteorus sp.*], Ichneumonidae [*Charops bicolor* Szepligeti, *Vulgichneumon leucaniae* Uchida, *Camposcopus* sp., *Netelia* sp.],

Number of generations and seasonal occurrence of *Mythimna separata* in China.

Generations per year	Seasonal occurrence	Host plants	Latitude
2-3	Jun-Jul	Wheat, maize, rice, sorghum, millet	North of 39° N
3-4	Jul-Aug	Wheat, maize, rice, sorghum, millet	36-29° N
4-5	Apr-May	Wheat, maize, rice, millet	33-36° N
5-6	Sep-Oct	Rice, maize	27-33° N
	Mar-Apr	Wheat	
6-7	Jan-Apr	Wheat	South of 27° N
	Sep-Oct	Rice, maize, sugarcane	

Scelionidae [*Telenomus cirphivorus* Liu.], and Carabidae [*Calathus halensis* Schall., *Calosoma maderae chinense* Kirby].

Seasonal migration in eastern China was traced by releasing and recapturing marked moths. Results indicate that the moth is a regular immigrant from the southern provinces to the northeast in early spring. A return migration takes place in late summer or fall.

The maize armyworm *Mythimna loreyi* Duponchel is found in Chekiang, Kiangsu, Kwangtung, Kwangsi, Fukien, Hunan, Hupeh, Szechuan, Kweichow, Kiangsi, Taiwan, and Ginsu Provinces. In Kwangtung, it damages rice in June-July by feeding on the leaves and cutting the spikelets. Parasites of *M. loreyi* include Tachinidae [*Cuphocera varia* Fabricius, *Pseudogonia rufifrons* (Wied.)], Braconidae [*Apanteles* sp.], and Ichneumonidae [*Enicospilus* sp.].

The grain armyworm *Mythimna compta* (Moore) is found in Hupeh, Hunan, Kiangsi, Yunan, Fukien, Chekiang, Kweichow, Kwangtung, and Kwangsi Provinces. In Fukien, it causes significant injury in June-July during its second generation and serious damage in October-November during its fifth generation. In Kwangtung, its infestation on rice is lighter than other species.

The millet armyworm *Mythimna zeae* (Duponchel) infests wheat, millet, and rice in Sinkiang Province in the west-northern part of China. It produces two generations a year and the full-grown larva hibernates in the soil. The first generation in June-July causes significant damage.

The nutgrass armyworm *Spodoptera mauritia* Boisduval is found in Kiangsu, Hupeh, Kiangsi, Kwangsi, Kwangtung, Taiwan, and Fukien Provinces. Caterpillars of the 5th generation attack rice severely in Kwangtung in July-August. It often occurs in rice fields that are easily flooded. An outbreak is closely related to water in the fields.

The small nutgrass armyworm *Spodoptera abyssinia* Guenée occurs in Hunan, Fukien, Kwangsi, and Kwangtung Provinces. The caterpillars infest rice seedlings during the second season in June-July in Kwangtung. The duration of the summer generation lasts about 33 days in Guangzhou.

The green nutgrass armyworm *Spodoptera depravata* (Butler) is found in Giling, Shensi, Hupeh, Kiangsi, Szechuan, Chekiang, Kiangsu, Fukien, and Kwangtung Provinces.

The striped nutgrass armyworm *Spodoptera pecten* Guenée occasionally infests rice in Fukien, Kwangtung, and Kwangsi Provinces.

Weed hosts of some rice pests in North Western Sierra Leone

A. M. Alghali and J. S. Domingo, Rice Research Station, Rokupr, Sierra Leone

Grasses in the rice fields of associated tidal mangrove swamps of Mawirr and Magbolontor and the mangrove swamp of the Rice Research Station in Rokupr, Kambi District, North Western Sierra Leone, were examined for adults, eggs, larvae, and nymphs of rice insect pests (see table). Insects at immature stages were reared to adults for identification.

Distribution of some rice insects on weeds in North Western Sierra Leone.

Insect	Insect stage	Site	Weed host	Rice crop stage
Diopsis thoracica West.	Eggs and adults	Mawirr	*Rottboellia exaltata* L.f.	Heading
Nephotettix modulatus Melichar	Nymphs	Mawirr	*R. exaltata*	Heading
			Ischaemum rugosum Salisb.	Heading
		Rokupr mangrove swamp	*Paspalum vaginatum* Swartz	Vegetative
Herpetogramma licarsisalis Walk.	Larvae	Mawirr	*I. rugosum*	Heading
Epilachna similis Muls.	Nymphs and adults	Mawirr	*R. exaltata*	Heading
Pteronemobius sp.	Eggs	Mawirr	*R. exaltata*	Heading
Hydrellia sp.	Feeding lesions	Mange	*Pennisetum purpureum* Schumach.	Heading

Life span and tungro transmission of viruliferous *Nephotettix virescens*

Dara Chettanachit and Somkid Disthaporn, Rice Pathology Branch, Division of Plant Pathology and Microbiology, Department of Agriculture, Bangkhen, Bangkok 9, Thailand

The rice tungro virus Collaborative Project investigated the life span and tungro transmission of *Nephotettix virescens*. In two trials in Thailand, 80 adult insects — 40 females and 40 males — each for 10 varieties were given 4 days access on tungro-diseased plants.

Transmission of the tungro virus was lowest in Gampai 30-12-15, Habiganj DW8, and Ambemohar 159, although these varieties were as susceptible to the hopper as TN1, based on life span.

Insect life spans ranged from 1 to 39 days, with an average of 7 days (7.5 for females and 6 for males). The short life spans on Pankhari 203 and Ptb 18 indicated that these varieties were more resistant than the others in the test.

Rice insect pests in Vietnam

Nguyen Cong That, Entomology Department, Institute of Plant Protection, Hanoi, Vietnam

The pattern of incidence of insect pests in Vietnam has changed considerably since the introduction of high-yielding rice varieties and accompanying technology in 1968. Several minor insect pests have become major economic fattors (see table).

Changes in the economic importance of rice insect pests in Vietnam.

Insect	Economic importance[a] 1956-68	Economic importance[a] 1969-81
Cnaphalocrocis medinalis (Guenée)	–	XXX
Tetroda histeroides Fabricius	–	XX
Baliothrips biformis (Bagnall)	–	X
Nilaparvata lugens (Stil)	X	XXX
Mythimna unipuncta (Haw.)	XXX	XXX
Orseolia oryzae (Wood-Mason)	XX	XX
Chilo suppressalis (Walker)	XXX	XX
Scirpophaga incertulas (Walker)	XXX	XX
Sesamia inferens (Walker)	XXX	XX
Gryllotalpa africana (P. de B.)	X	X
Sogatella furcifera (Horvath)	X	X
Leptocorisa acuta (Thunberg)	X	X
Nymphula depunctalis (Guenee)	X	X
Chlorops oryzae (Mats.)	X	X
Nephotettix nigropictus (Stal)	X	–
Nephotettix virescens (Distant)	X	–
Scotinophora lurida Burmeister	X	–
Parnara guttata (Bremer & Grey)	XXX	–
Pelopidas mathias (Fabr.)	XXX	–
Spodoptera mauritia (Boisd.)	XXX	–
Dicladisua armigera (Olivier)	XXX	–

[a]xxx = causing severe damage every year; xx = causing extensive damage in some areas every year; x = causing heavy damage under certain conditions; – = negligible damage.

Nilaparvata lugens, a minor problem during the 1960s, has become increasingly prevalent during the 1970s in several rice-growing areas. *Cnaphalocrocis medinalis* shows a similar change.

But *Spodoptera mauritia, Parnara guttata, Pelopidas mathias,* and *Dicladispa armigera,* defined as major insect pests in the 1960s, are minor pests now.

Incidence of some insects has increased in certain areas of the country during critical times of the growing season. *Chilo suppressalis, Scirpophaga incertulas,* and *Sesamia inferens* are problems in the Red River Delta. *C. suppressalis* causes extensive damage in the dry season, *S. incertulas* in the wet season, and *S. inferens* in both seasons.

Mythimna unipuncta causes serious damage during the preharvest stage in the wet season in the northern provinces. *Orseolia oryzae* is more dominant during seedling and tillering stages in the dry season in the central provinces. *Leptocorisa acuta, Tetroda histeroides, Scotinophora lurida,* and *Baliothrips biformis* occasionally cause extensive damage in some locations.

GENETIC EVALUATION AND UTILIZATION

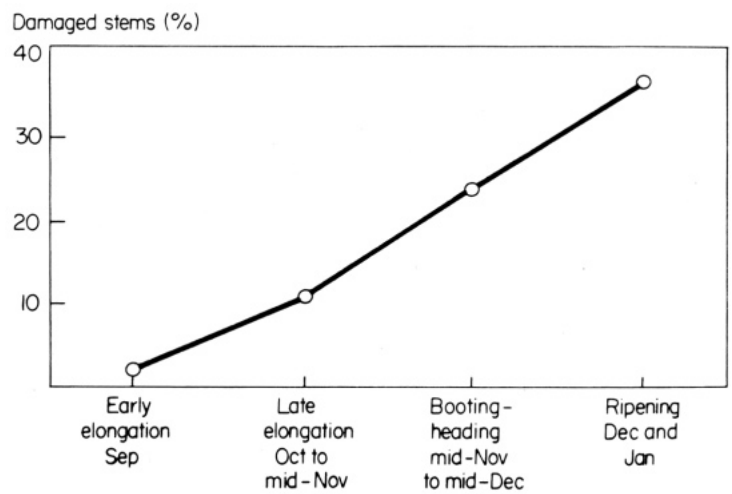
Deep water

Yellow rice borer incidence in deepwater rice in Thailand, 1981

H. D. Catling, IRRI, Thailand, and Raywat Pattrasudhi, and Samlee Boonyaviwatana, Department of Agriculture, Bangkhen, Thailand

Rice borer damage was surveyed in 63 deepwater rice fields distributed over the Central Plains of Thailand. The survey from flood inundation to harvest included 24 farmer-named rice varieties, mostly floating types.

The yellow rice borer *Scirpophaga incertulas* (Walker) comprised more than 95% of the borer population in rice stems dissected. The number of damaged stems increased from 3% at the early elongation stage to 37% at harvest (see figure). An exceptionally high 71% damaged stems at the ripening stage was recorded for 3 fields of Leb Mue Nahng 111 at Prachin Buri.



Average incidence of stems damaged by rice borer, predominantly the yellow rice borer *Scirpophaga incertulas,* in deepwater rice fields. Thailand, 1981.

At an outbreak threshold of 20% damaged stems, 67% of the fields were at outbreak level in the booting and heading stage and 89% were at harvest. Counts in 35 fields at harvest showed 2.5% whiteheads, a ratio of 1 whitehead to 15 damaged stems.

Pest management and control INSECTS

Insectary evaluation of insecticides to control rice stink bugs

E. A. Heinrichs, S. L. Valencia, and R. P. Basilio, International Rice Research Institute

Rice bugs (*Leptocorisa oratorius*) were reared by the method described by Valencia and Heinrichs (this issue). Rice variety IR36 plants at the flowering stage were used as test plants. Three tests were conducted.

In test 1, four panicles were sprayed. In tests 2 and 3, four hills were sprayed on a turntable. In tests 1 and 2, concentrations were based on manufacturers' recommendations. In test 3, new insecticides were compared with monocrotophos and were applied at the rate of 0.75 kg a.i./ha, based on 160,000 hills and 1,000 liters of spray solution per hectare.

One day after spraying, panicles were placed in a mylar film cage with 10 two-day-old female rice bug adults. Mortality was recorded 48 hours later. In test 3, residual activity was measured by determining mortality 7 and 14 days after treatment (DAT). Treatments were replicated four times.

Seven insecticides in test 1 and four in test 2 were effective (≥ 80% mortality) at the concentrations tested (Table 1). In test 3 (Table 2), UC 54229, M 9918, M 10604, methiocarb, methidathion, and UC 27867 were effective 1 DAT. M 9918 had the longest residual activity, causing 77% mortality 14 DAT.

Table 1. Activity[a] of insecticides applied as foliar sprays to control rice bugs. IRRI greenhouse, 1979.

Insecticide	Concentration (%)	Mortality (%)
Test 1		
Effective		
Monocrotophos 16.8 EC	0.05	100 a
Endosulfan 35 EC	0.06	100 a
Chlorpyrifos 40 EC	0.016	100a
Phosphamidon 50 EC	0.07	100 a
Acephate 40 EC	0.09	99 a
Triazophos 40 EC	0.07	98 a
Carbaryl 85 WP	0.12	91 b
Intermediate		
MIPC 50 WP	0.07	74 bc
Carbophenothion 40 EC	0.09	73 bc
Methyl parathion 50 EC	0.07	56 c
Chlorpyrifos + BPMC 31.6 EC	0.14	50 c
Ineffective		
Carbofuran 12 F	0.01	19 d
Azinphos ethy l40 EC	0.07	3 e
MTMC 30 EC	0.11	3e
Control		3e
Test 2		
Effective		
Monocrotophos + mevinphos 20.2 EC	0.06	100 a
Diazinon 20 EC	0.21	100a
Fenitrothion 30 EC	0.05	98 ab
Pirimiphos methyl 25 EC	0.03	85 b
Ineffective		
FMC 35001 20 EC	0.02	28 c
BPMC 50 EC	0.05	23 c
Ethion 40 EC	0.04	8 cd
Permethrin 10 EC	0.01	0 d
Control		0 d

[a] Insects were placed on treated panicles 1 day after treatment and mortality recorded 48 hours after infestation. Means followed by a common letter are not significantly different at 5% level. Effective =>80% mortality, intermediate = 50-79% mortality, ineffective = <50% mortality.

Table 2. Knockdown and residual effect of insecticides against rice bugs. IRRI greenhouse, 1979.

Insecticide	Mortality (%)		
	1 DAT	7 DAT	14 DAT
UC54229 100 Tech.	100.0 a	100.0 a	56.7 b
M 9918 20 OE	100.0 a	96.7 ab	76.7 a
M 10604 20 OE	100.0 a	86.7 b	43.3 bc
Monocrotophos 16.8 EC	100.0 a	36.1 c	20.0 c
Methiocarb 50 WP	100.0 a	20.0 cd	3.3 d
Methidathion 40 EC	93.3 a	10.0 de	0.0 d
UC 27867 50 WP	83.3 a	0.0 e	3.3 d
Cypermethrin 5 EC	56.7 b	3.3 e	0.0 d
Dioxacarb 50 WP	10.0 c	0.0 e	0.0 d
Dioxathion 96 EC	3.3 c	3.3 e	0.0 d
UC SF-1 40 F	3.3 c	3.3 e	0.0 d
RP 32861 20 EC	0.0 c	13.3 de	0.0 d
EXP 5494 25 EC	0.0 c	3.3 e	0.0 d
RH 0308 48 EC	0.0 c	0.0 e	3.3 d
RH 0994 48 EC	0.0 c	3.3 e	3.3 d
Control	0.0 c	3.3 e	0.0 d

[a] In a column, means followed by a common letter are not significantly different at the 5% level. DAT= days after treatment.

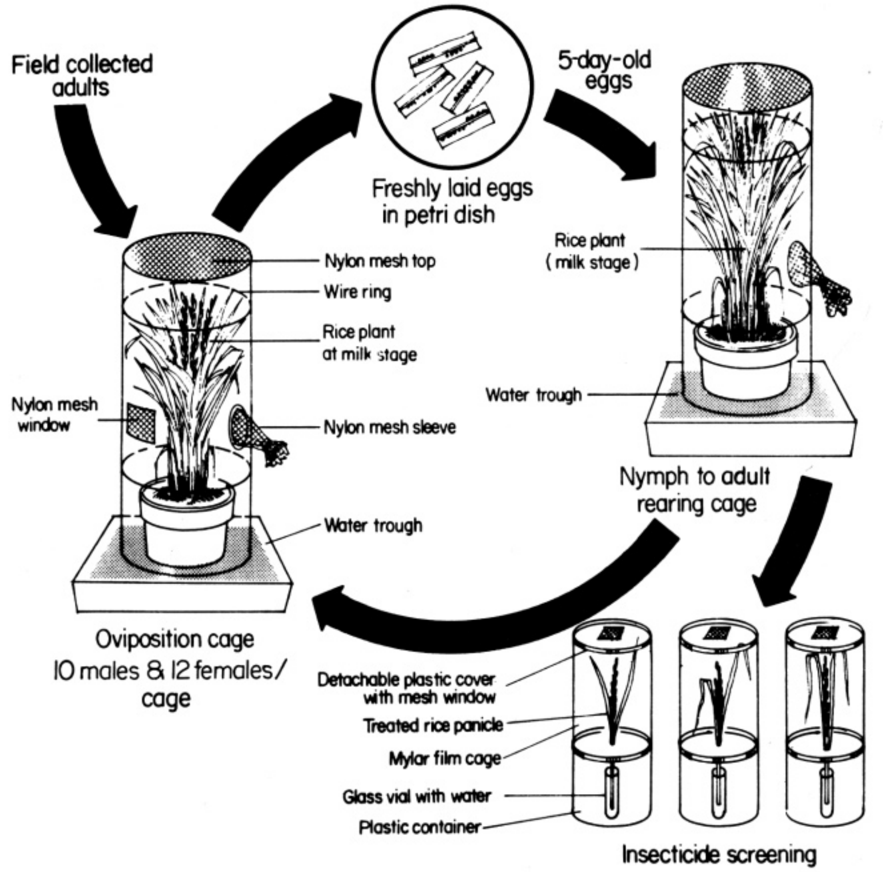
Mass rearing of rice stink bugs

S. Valencia and E. A. Heinrichs, International Rice Research Institute

Rice bugs, *Leptocorisa* spp., occur throughout Asia. Heavy feeding on rice grains in the milky stage prevents grain development and results in unfilled grains. The primary control is spraying or dusting with insecticides. Little evaluation of insecticides for control has been published, primarily because of the difficulty of conducting field tests. We have developed a mass rearing technique for *L. oratorius* which supplies sufficient insects to evaluate insecticides in the insectary and laboratory. The method also can be used to supply rice bugs for varietal screening and other studies.

Steps for mass rearing of *L. oratorius* follow:

- Collect adults from the field with a sweep net, verify species and sex.
- Release a group of 10 males and 12 females into an oviposition cage 97 cm tall and 27 cm in diameter (see figure). IRRI's cage consists of mylar film reinforced with two heavy gauge wire rings. The cage rests in a trough containing water to maintain high humidity. Any susceptible rice variety can serve as a food source and substrate on which insects can lay eggs. We use early-maturing variety IR36 to shorten the time required to grow plants to the ripening stage.
- Provide fresh plants in the milk grain stage once a week.
- Collect eggs from the oviposition cage daily by clipping the leaf portion containing the eggs.
- Place leaf pieces in a petri dish containing moist filter paper and store for 5 days at room temperature.
- Five days after oviposition, transfer leaf pieces with eggs to the nymph rearing cage, which is identical to the oviposition cage.
- Clip leaf pieces with eggs to the base of panicles at the milk grain stage of the rice plant in this cage. After hatching, nymphs will move up to the developing grains to feed. Change plants in this cage once a week.



A method for mass rearing *Leptocorisa oratorius* for use in insecticide screening studies. IRRI, 1982.

Depending on the temperature at Los Baños, nymphs become adults in 17-33 days. Transfer some adults to the oviposition cage to maintain the colony.

The excess of 1- and 2-day-old adults can be used for bioassay of insecticides. The 12 females in one oviposition cage will provide sufficient eggs for 2 nymph-to-adult rearing cages, producing about 300 adults/day.

Chemical control of the whitebacked planthopper in Pakistan

Muhammad Akram Zafar, senior subject matter specialist (Plant Protection), adaptive research farm, Sheikhupura, Pakistan

Damage from the whitebacked planthopper (WBPH) *Sogatella furciferaera* (Horvath) is increasing in Pakistan, partitularly to high-tillering rice varieties. The only control that has been applied is minor dusting with BHC or BHC + DDT in seriously infested areas. An experiment was conducted during the 1980 wet season to identify insecticides effective for WBPH control.

The trial on IR6 rice in farmers' fields in Sheikhupura was laid out in completely randomized blocks with three replications and was repeated in two different but climatically and topographically similar fields. Fields were heavily infested with WBPH. MIPC and carbaryl were sprayed at 375 liters/ha, and pyridaphenthion (Ofunack) and BHC +

Insecticide control of whitebacked planthopper in Pakistan.

Treatment	Formulation	Dosage (kg a.i./ha)	Pest density (no./5 sweeps) at		Pest control (%.) after	
			3 days	15 days	3 days	15 days
MIPC	50 WP spray	1.250	2	22	97	70
Carbaryl	85 SP spray	2.125	2	35	98	52
Pyridaphenthion	2% dust	0.750	5	28	93	62
BHC + DDT	10% dust	0.375 + 0.875	11	26	85	64
Control	–	–	69	74	–	–

DDT were dusted at 37.5 and 12.5 kg/ha.

Live insects were collected with 5 sweeps of a net at scattered spots in each plot before and 3 and 15 days after application.

All insecticides gave significant control of WBPH at 3 days, then effectiveness decreased (see table). MIPC and carbaryl gave excellent control at 3 days Evidently, insecticide application should be repeated every 10-15 days.

Control of rice mites

G. Chakkaravarthy, P. Karuppuchamy, and M. Gopalan, Tamil Nadu Rice Research Institute, Aduthurai 612101, India

A trial in 1980 kuruvai season evaluated insecticides for controlling the rice mite *Oligonychus oryzae* (Hirst). A severe infestation on rice variety ADT36 was utilized. Insecticides monocrotophos (Nuvacron), methyl demeton (Metasystox), phosalone (Zolone), phosphamidon (Dimecron), and endosulfan (Corosulfan) were sprayed at 625 liters/ha on 20-m^2 plots. Mite density was observed, 72 hours after treatment, on 1-cm^2 leaf areas or 10 leaves selected randomly from 10 hills/plot.

All insecticides reduced mite density; monocrotophos was most effective (see table).

Effect of insecticides on rice mite density at Tamil Nadu, India.

Insecticide	Formulation	Dosage (kg a.i./ha)	Mite density[a] (no./10cm ^{2} leaf area)	Pest reduction (%)
Monocrotophos	40 EC	0.25	Sa	90
Methyl demeton	25 EC	0.16	15 c	68
Phosalone	35 EC	0.22	22 d	55
Phosphamidon	100 EC	0.63	10 b	78
Endosulfan	35 EC	0.22	10 b	79
Control	–	–	48 e	–

[a] Means followed by a common letter are not significantly different at 0.05% level.

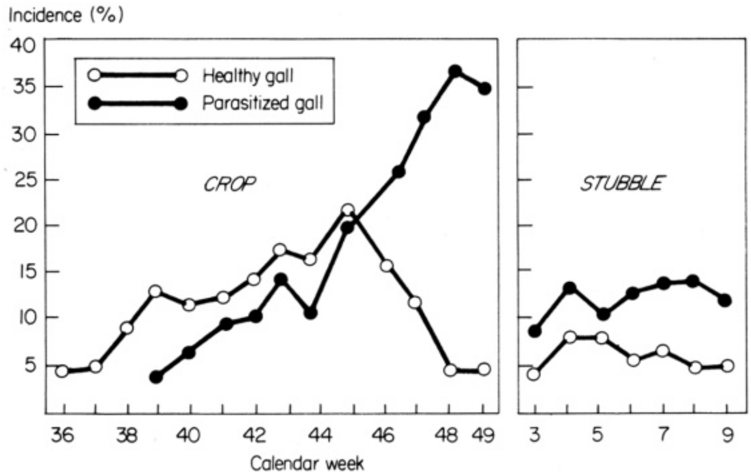
Rice gall midge and its parasites

S. K. Shrivastava, M. P. Rice Research Institute, Raipur, M. P. (India)

The damage caused by the gall midge *Orseolia oryzae* in Madhya Pradesh and adjoining states is influenced by parasites. A trial with the highly susceptible variety TN1 during the 1978 wet season continued on stubble during the dry season. Healthy and parasitized gall midges were recorded weekly on tillers from early September (36th calendar week) 1978 to early December (49th calendar week) and on stubble from mid-January (3d calendar week) 1979 to early March (9th calendar week).

Gall midge infestation started the first week of September, gradually reaching a maximum in the second week of November (see figure). Parasitization started the fourth week of September and reached its highest level the last week of November. In stubble, the gall midge population was 3.4-8.4% and the parasite population was 8.5-15.8%.

The data show the role of parasites in minimizing pest pressure.



Incidence of healthy and parasitized gall midge in Raipur, M.P., India, 1978-79

Evaluation of insecticides for toxicity to brown planthopper eggs and nymphs

N. V. Krishnaiah, junior entomologist; M. B. Kalode, senior entomologist; and Y. R. B. Sarma, computer assistant, All-India Coordinated Rice Improvement Project, Rajendranagar, Hyderabad-500 030 Andhra Pradesh, India

Fourteen insecticides were tested for knockdown effect and persistent toxicity against brown planthopper (BPH) *Nilaparvata lugens* (Stal) nymphs. The insecticides were sprayed on 40-day-old TN1 plants. Insects were caged at regular intervals.

Fenvalerate, cypermethrin, and carbosulfan as 0.05% sprays exhibited quick knockdown effects and persistent toxicity. However, fenvalerate and cypermethrin were less persistent at normally recommended concentrations (0.01 and 0.005%). BPMC showed good knockdown effect but had less persistent toxicity. Isofenphos (EC and WP), bendiocarb, endosulfan, phenthoate, acephate, MIPC, UC51762, phosmet, and phoxim were less toxic.

Contact studies with the Potters

Spray Tower showed that cypermethrin, fenvalerate, and carbosulfan were the most toxic, and endosulfan the least toxic (Table 1). For phosalone, a tenfold difference in LC50 values existed between 4-hour and 48-hour exposures.

Carbaryl, phosphamidon, phosalone, quinalphos, endosulfan, chlorpyriphos, isofenphos, fenthion, thiometon, fenitrothion, dimethoate, and phenthoate were relatively less toxic.

Translocation of insecticide applied to foliage was measured by shielding the lower portion of test plants and spraying the upper foliage. BPH nymphs were confined to the lower unsprayed portion. Of 9 insecticides evaluated, BPMC exhibited downward translocation but the effect did not persist beyond 5 days. Chlorpyriphos, isofenphos, dicrotophos, carbofuran, monocrotophos, demeton-O-methyl, carbaryl, and MIPC did not show appreciable translocation.

To evaluate ovicidal activity, spray formulations (0.05%) were tested on 1-day-old BPH eggs. Carbosulfan, MIPC, BPMC, knockbal, carbaryl, isofenphos, phosalone, and monocrotophos had the highest ovicidal activity. Cypermethrin and fenvalerate were poor ovicidal agents (Table 2).

Table 1. Contact toxicity of selected insecticides against brown planthopper nymphs (Potters Spray Tower method) at Hyderabad, India.

Insecticide	LC_{50}	
	After 4 h	After 48 h
Cypermethrin	0.0052	0.0061
Fenvalerate	0.0089	0.0070
Carbosulfan	0.0123	0.0101
Permethrin	0.0667	0.0389
BPMC	0.0864	0.0408
Monocrotophos	0.0814	0.0426
Phosalone	0.243	0.0210
Quinalphos	0.225	0.147
Endosulfan	0.299	0.151

Table 2. Ovicidal activity of selected insecticides at Hyderabad, India.

Insecticide (0.05% spray)	Hatching (%)
Carbosulfan	0
MIPC	0
BPMC	0
Knockbal	1
Phosalone	9
Isofenphos	7
Carbaryl	7
Monocrotophos	13
Cypermethrin	58
Fenvalerate	67
Untreated control	83

Synthetic pyrethroids for controlling leaffolders on rice

R. Saroja and N. Raju, Paddy Experiment Station, Tirur 602025 India

Three synthetic pyrethroids for controlling rice leaffolders, a treated control (fenthion 500 g a.i./ ha), and an untreated control were studied during 1980-81 samba (July-August to November-December). The field trial was laid out in a randomized complete block design with nine treatments and three replications. Chemicals were sprayed at 15, 30, and 45 days after transplanting (DT) IR8.

All chemical treatments, especially permethrin, checked leaffolders. Plots treated with the 3 synthetic pyrethroids had higher yields than the untreated control, and plots sprayed with cypermethrin at 75 g a.i./ha yielded more than the treated control (see table).

Controlling rice leaffolders by synthetic pyrethroids in Tirur, India.

Treatment	Formulation	Dosage per application (g a.i./ha)	Leaf damage (%) 60 DT	Grain yield (t/ha)
Cypermethrin	10 I C	25	27.30	3.65
Cypermethrin	10 EC	50	18.96	3.53
Cypermethrin	10 EC	75	19.26	4.42
Permethrin	10 EC	75	7.95	3.41
Fenvalerate	20 EC	75	22.99	3.54
Fenvalerate	20 EC	100	28.78	2.81
Fenvalerate	20 EC	125	27.92	2.99
Fenthion (treated control)	50 EC	500	21.07	2.74
Untreated control	–	–	39.13	1.89
CD (P = 0.05)	–	–	2.00	1.21

Field control of yellow stem borer by foliar and granular insecticides in Punjab, India

G. S. Dhaliwal, Jaswant Singh, and D. P. Singh, Punjab Agricultural University Rice Research Station, Kapurthala - 144601, Punjab, India

The yellow stem borer *Scirpophaga incertulas* (Walker), a serious rice pest in the Ferozepur district of the Punjab, is spreading to other parts of the state. Six spray and five granular formulations at 0.50 and 1.00 kg a.i./ ha were tested for yellow stem borer control in 25 m^2

Spray and granular formulation control of the yellow stem borer in Punjab, India, 1981.

Treatment[a]	Deadhearts (%)[b]		Whiteheads (%)[b]
	50 DT	70 DT	90 DT
Carbaryl -*gamma* BHC	2.12 b	7.33 de	3.02 ef
Carbofuran	0.74 a	4.94 bc	1.55 b
Chlorpyrifos	1.67 b	4.90 ab	0.71 a
Fenitrothion	11.32 f	10.33 f	3.65 ef
Gamma BHC	4.58 c	6.13 cd	3.29 def
Methyl parathion	7.75 de	9.22 ef	3.91 f
Monocrotophos	2.05 b	9.23 ef	1.55 bc
Phorate	1.93 b	3.70 ab	1.41 ab
Phosalone	8.55	9.44 ef	2.43 cde
Phosphamidon	5.02 cd	3.08 a	1.75 bcd
Quinalphos	4.62 cd	8.18 ef	3.62 ef
Control (untreated check)	15.93 g	16.80 g	12.21 g

[a]Spray and granular formulations at 0.50 and 1.00 kg a.i./ha, respectively, were applied at 30, 50, and 70 days after transplanting (DT). [b]Means followed by a common letter in a column are not significantly different at the 5% level.

farmers' field plots near Ferozepur. Deadhearts and whiteheads were recorded on 10 random hills in each plot. Insecticides were applied 30, 50, and 70 days after transplanting (DT) and stem borer incidence was recorded 20 days after treatment (50, 70, and 90 DT).

All treatments significantly reduced stem borer damage (see table). Carbofuran applied 30 DT was the most effective treatment. Phosphamidon, phorate, and chlorpyrifos applied 50 DT were highly effective. Chlorpyrifos and phorate applied 70 DT were effective.

Irrigation and water management

Response to irrigation of winter crops sown after paddy rice harvest in Madhya Pradesh, India

R. A. Khan, A. K. Swarnkar, G. R. Sahu, and Suresh Sharma, Madhya Pradesh Rice Research Institute, J. N. K. V. V., Raipur, India

With the availability of some irrigation water during the winter season, it has become essential to select suitable crops to follow rice in a double-cropping system. An experiment at the Labhandi and Baronda, Raipur centers in 1978-79 studied the response to irrigation of winter crops sown after the monsoon paddy rice crop. Experimental fields soils are clay loam at Labhandi and loam at Baronda. Experimental crops were sown 20 December 1978 at Labhandi and 27 December at Baronda at recommended seeding and fertilizer rates. Irrigation treatments were 7-8 cm water per application (see table).

Wheat, safflower, gram, and urd were economically profitable at Labhandi. Yield and net return to labor from wheat and urd increased with irrigation applications. Safflower and gram did not show any appreciable change over one irrigation. Linseed, mungbean, lathyrus, and black soybean were not economical. Safflower gave the

Response of late sown winter crops to irrigation at Madhya Pradesh, 1978-79.

Crop	Irrigation treatment[a]	Grain yield (t/ha)		Cost ($) of grain[b]		Cost of inputs[c]	Net return ($)	
		Labhandi	Baronda	Labhandi	Baronda		Labhandi	Baronda
Wheat (Sonalika)	1	1.6	2.4	187.75	282.54	79.52	108.23	203.30
	2	2.2	2.7	258.59	324.77	86.38	172.21	238.39
	3	2.3	2.9	272.49	349.45	93.23	179.25	256.22
Mean		2.02	2.7	239.58	318.92	86.38	153.20	232.54
Gram (Ujjain 21)	1	1	0.2	168.10	42.87	56.31	111.79	–22.58
	2	1	0.3	166.54	44.61	63.16	103.38	–18.55
	3	1	0.3	180.62	52.10	70.02	110.60	–16.82
Mean		1	0.3	171.75	46.53	63.16	108.59	–19.29
Lathyrus	1	0.1	–	22.76	–	55.21	–32.45	–
	2	0.1	–	25.96	–	62.06	–36.11	–
	3	0.1	–	24.13	–	68.92	–44.79	–
Mean		0.1	–	24.31	–	62.06	–37.75	–
Linseed	1	0.2	0.2	59.05	48.81	61.88	–30.25	–6.40
	2	0.2	0.3	49.00	64.10	68.74	–19.74	–2.10
	3	0.2	0.2	57.31	55.85	75.59	–18.28	–13.07
Mean		0.2	0.2	55.12	55.94	68.74	–13.62	–5.76
Mung (Baisakhi)	1	0.1	0.1	25.78	39.21	44.88	–19.10	–22.67
	2	0.1	0.1	23.67	25.78	51.74	–28.06	–42.96
	3	0.1	0.1	18.01	28.52	58.59	–40.58	–47.07
Mean		0.1	0.1	22.49	31.17	51.74	–29.25	–37.57
Urd	1	0.3	0.3	71.66	65.36	44.79	26.78	20.48
	2	0.5	0.3	110.15	63.07	51.74	58.41	11.33
	3	0.6	0.2	143.42	37.48	58.59	84.83	–21.12
Mean		0.51	0.2	108.41	55.30	51.74	56.67	3.56
Safflower	1	1.3	0.7	196.62	111.15	41.13	155.48	70.02
	2	1.2	0.6	181.81	97.17	47.99	133.82	49.18
	3	1.5	0.6	231.36	97.26	54.84	176.42	42.41
Mean		1.3	0.7	203.20	101.83	47.99	155.21	53.84
Black soybean	1	0.2	0.1	40.04	22.49	45.34	–5.30	–22.85
	2	0.2	0.1	31.08	17.73	52.19	–21.11	–34.46
	3	0.2	0.1	37.66	20.66	59.05	–21.39	–38.39
Mean		0.24	0.1	36.29	20.29	52.19	–15.90	–31.90

[a]In addition to sowing irrigation. [b]Cost of grain (converted at the rate of US$1 = 10.94 rupees) is $118.83/t wheat, $173.67/t gram, $210.10/t lathyrus, $251.37/t linseed, $274.22/t mung, $228.52/t urd, $155.39/t safflower, $182.82/t black soybean. [c]Inputs include seeds, nutrients, and irrigation: $0.28/kg nitrogen, $0.31/kg P_2O_5, $0.11/kg K_2O, and $0.07 each application of irrigation.

maximum net return to labor under one irrigation. Wheat was the most economical under two and three irrigations. The net return to labor under three irrigations was nearly equal for wheat and safflower.

At Baronda, only wheat and safflower produced profitable net returns to labor. Wheat yield increased with number of irrigations. The maximum safflower yield was obtained with one irrigation. Wheat was the most profitable.

Environment and its influence

Flowering behavior of ratooned photoperiod-sensitive rices

S. K. Bardhan Roy, J. Mondal, and R. Ghosh, Rice Research Station (RRS), Chinsurah 712102, West Bengal, India

Ratooning photoperiod-sensitive rice varieties during the dry season may avoid flood or water stagnation damage in low-lying flood-prone areas during the wet season. Both the main crop and its ratoons must be photoperiod sensitive in such a cropping system. A preliminary study of flowering behavior was conducted in RRS (22°52'N) fields at Chinsurah in 1980-81.

Six photoperiod-sensitive, traditional tall indica rice varieties — NC365, FR 13A, Achra l08/1, Nagra 41/14, SR26B, and Bansmoti aman — sown the first week of November 1980 flowered in late March or early April. Each variety was ratooned at maturity in May. The ratoons of FRI3A, SR26B, and Achra l08/1 showed another flush of flowering in early June. The ratoons of NC365 and Bansmoti aman did not flower till October. The ratoon of Nagra 41/14 flowered irregularly throughout the growing period. All varieties showed further vegetative growth and flowered the third week of October (see table). Three distinct types of flowering behavior and related photoperiod are shown in the figure.

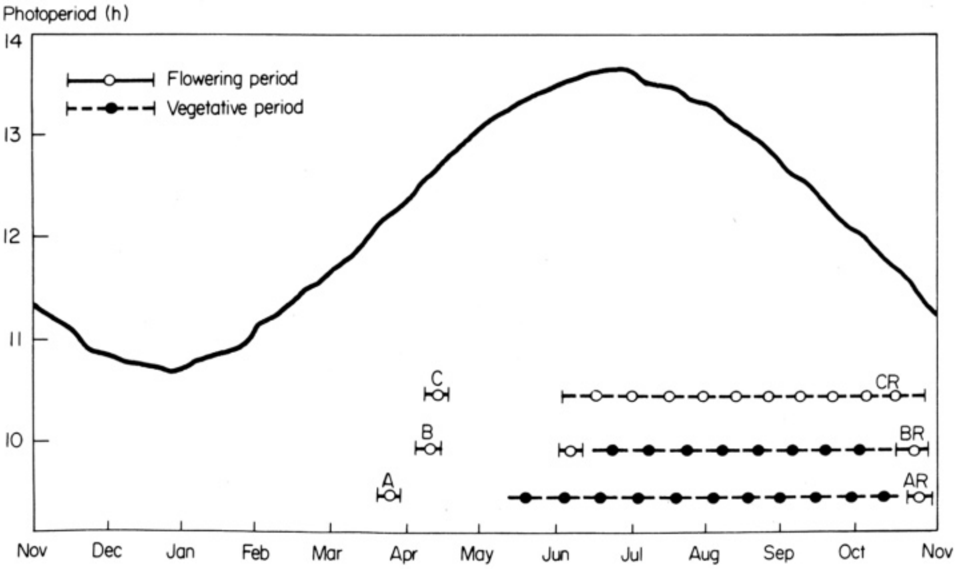
The flowering behavior of ratoons was not different from that of the normal July sowing.

Varietal differences in ratoon flowering offer a criterion for selection of varieties for this cropping system. Bansmoti aman and NC365 appear to be suitable, as they did not show any intermediate or irregular flowering after main crop harvest.

Flowering behavior of photoperiod-sensitive rice varieties and their ratoons grown during the 1981 dry season in West Bengal.

Variety	Main crop 50% flowering date	Ratoon flowering 1st flush	Growth phase (Jun-Sep)	Ratoon full flowering 2d flush	Normally sown crop full flowering
NC365	28 Mar	nil	Vegetative	24 Oct	25 Oct
Bansmoti aman	24 Mar	nil	Vegetative	22 Oct	22 Oct
SR26B	4 Apr	1-7 Jun 90%	Vegetative[a]	22 Oct	25 Oct
Achra 108/1	6 Apr	1-7 Jun 30%	Vegetative[a]	22 Oct	25 Oct
FR13A	6 Apr	6-15 Jun 50%	Vegetative[a]	22 Oct	24 Oct
Nagra 41/14	8 Apr	Jun-Oct irregular	Flowering	–	23 Oct

[a]After flowering, 1st flush ratoon showed further vegetative growth.



Flowering behavior of photoperiod-sensitive rice varieties and their ratoon under different photoperiods. A = NC365, B = Achra 108 1, C = Nagra 41/14 and, R = ratoon.

Soil and crop management

Effect of dipping rice roots in phosphate nutrient solutions on grain yield

Y. Yogeswara Rao, Mohd. Ikranullah, and L. G. Giri Rao, Students' Farm, Rajendranagar, Hyderabad, India

Roots of rice seedlings were dipped in phosphate nutrient solutions of potassium dihydrogen phosphate (KH_2PO_4), monoammonium phosphate (MAP), urea ammonium phosphate (UAP), and ammonium nitro phosphate (ANP) with and without soil application of P_2O_5 in field experiments at Rajendranagar, Hyderabad, India, during rabi 1975 and 1976. The treatments were in a randomized block design with four replications. The roots were kept for 10 minutes in phosphatic fertilizer solution before transplanting.

Yield differences were significant in both years. Application of only nitrogen and potassium without P_2O_5 gave a very low yield (3.9 t/ha), showing the rice crop's need for P_2O_5. The control (no manure) had the lowest grain yield. The differences in grain yield among treatments with KH_2PO_4, MAP, UAP, and ANP 2% solution were not significant, indicating that treating rice seedlings with any of the solutions will be equally beneficial.

Dipping roots of seedlings in phosphate solutions did not fully compensate for the phosphorus supplied through soil application of 60 kg P_2O_5/ha. When 30 kg P_2O_5/ha was applied in addition to seedling treatment with 2% solutions, grain yield was higher than when seedlings were dipped in 2% solutions without 30 kg P_2O_5/ha, but equal to yield with soil application of 60 kg P_2O_5/ha.

Net returns were maximum with 100 N, 30 P_2O_5, 30 K_2O kg/ha + root dipping in 2% ANP ($291 /ha) and with 100 N, 30 P_2O_5, 30 K_2O kg/ha + root dipping in 2% UAP ($280/ha), which registered an increase in net return of $49/ha and $38/ha over 100 N, 60 P_2O_5, and 30 kg K_2O kg/ha treatment.

It appears that dipping roots in a 2% solution of ANP or UAP plus soil application of 30 kg/ ha P_2O_5 /ha was more profitable than soil application of 60 kg P_2O_5/ha alone.

Groundwater and vegetative growth, yield components, and evapotranspiration demand of dryland rice

Tapan Ghosh, K. C. Sharma, and G. L. Sharma, Agronomy Department. G. B. Pant University of Agriculture and Technology, Pantnagar. U. P. (India)

A 1980-81 field experiment at Pantnagar, India, investigated the contribution of groundwater to vegetative growth, yield components, and evapotranspiration demand (ET) of dryland rice. Groundwater contribution was estimated as the difference in ET for polyethylene-lined and unlined plots. ET was varied by applying irrigations at 25%, 50%, and 75% moisture depletion from field capacity.

At maturity, significant differences in growth parameters occurred among treatments (see table). Significantly greater numbers of panicles were observed when groundwater contribution was high — 25% available soil moisture depletion from 0-30, 30-60, and 60-90 cm depths. Other yield attributes also were maximum under the wetter regime (25% moisture depletion) than under drier regimes (50% and 75% moisture depletion). Total dry matter (grain and straw) was maximum when irrigation was applied at depletion of 25% available moisture at 30-60 cm depth. That showed a groundwater contribution of 108 cm (see table). Yield attributes and yield decreased when the contribution of groundwater was low (50% and 75% moisture depletion treatments).

Estimates of the contribution of groundwater to total evapotranspiration (ET) and the effect on growth, yield, and yield components of dryland rice (Cv UPR82-1), 1980 in Pantnagar, India.

Treatment (% moisture depletion from field capacity at particular soil depth)		ET under lined plot (cm)	ET under unlined plot (cm)	Groundwater contribution (cm)	Growth parameters at maturity		Yield components			
					Crop density (no. of shoots/m row length)	Crop height (cm)	Panicles (no./m row length)	Grain wt (g/panicle)	Grain yield (t/ha)	Total dry matter (t/ha)
25%	0-30 cm	402	249	153	177	66	71	1.83	4.0	8.4
	30-60 cm	277	169	108	167	67	68	1.89	4.1	8.8
	60-90 cm	183	132	51	164	73	66	1.79	3.6	7.8
50%	0-30 cm	267	169	69	150	66	64	1.78	3.5	7.1
	30-60 cm	202	156	46	141	59	57	1.78	3.5	7.7
	60-90 cm	154	131	23	134	65	58	1.77	3.2	6.8
75%	0-30 cm	248	229	18	106	59	56	1.74	2.9	6.3
	30-60 cm	190	165	24	100	62	55	1.66	2.9	6.1
	60-90 cm	163	150	13	86	64	55	1.64	2.7	5.7
F test					Significant	Significant	Significant	Nonsignificant	Significant	Significant
C.D. at 5%					14.0	1.4	3.0	–	0.5	1.4

The contribution of groundwater to total ET was maximum when plants were irrigated at 25% available soil moisture depletion at 0-30 cm depth. In drier regimes, the rice plant failed to extract moisture from the groundwater table, although the gradient of water potential was maximum. Liquid phase continuity was disturbed under the drier soil regimes, reducing groundwater contribution to a minimum.

Response of rice varieties to nitrogen manuring at Tirur, India

S. Nazeer Peeran and B. V. Anandam, Soil Science Section, Paddy Experiment Station, Tirur 602025, Chingleput District, Tamil Nadu, India

A field trial during *sornavari* 1980 (May-June to August-September) studied the yield potential of pre-release cultures under different levels of nitrogen fertilizer (N). Six rice varieties and five N levels were tested in a split-plot design replicated twice (see table).

Yield differences were statistically significant for the interaction of nitrogen levels and rice varieties. TKM9 had the highest yield at all N levels of treatment, but had low response to N.

Grain yields (t/ha) of 6 rices treated with 5 nitrogen levels at Tirur, India.

Varieties	Grain yield (t/ha)						Fertilizer index
	No N	40kg N/ha	80 kg N/ha	120kg N/ha	160 kg N/ha	Mean	
AS1374	3.1	3.9	4.4	5.5 [a]	4.9	4.3	1.3
TM3207	2.8	3.4	4.0	4.3	4.7 [a]	3.8	1.2
TM2871	2.9	3.8	3.8	4.4	5.0 [a]	4.0	1.3
TM2048	2.8	3.2	3.8	4.1	4.3 [a]	3.1	1.2
TM1898	3.2	3.8	4.8	5.0	5.6 [a]	4.5	1.3
TKM9	3.6	4.0	5.0	5.6 [a]	5.5	4.7	1.2
Mean	3.1	3.7	4.3	4.8	5.0		
			F-test		SE	CD	
Variety			S**		0.095	0.541	
N levels			S**		0.053	0.345	
Interactions:							
N level × variety			S**		0.088	0.347	
Variety × N level			S**		0.103	0.561	

[a] Highest optimum yields. **Significant at 0.99 level.

Contribution of seedling quality to rice production

S. A. Sattar, Harun-Ar-Rashid, and A. J. M. A. Islam, Bangladesh Rice Research Institute (BRRI)

The contribution of seedling quality to grain yield and growth duration of transplanted rice was studied in the cold, dry, and wet seasons. High quality seedlings were produced by giving better management in the nursery; poor quality ones were obtained from a poorly managed nursery. A physical seedling quality index (SQI) was calculated (Table 1) and used for correlation analysis with yield, growth duration, and seedling strength measured in milligrams of dry matter produced per centimeter length of seedling.

The SQI correlated strongly with seedling strength (Table 2). SQ had no influence on grain yield and was negatively associated with growth duration. But high quality seedlings shortened crop growth duration by at least 6-10 days.

Table 1. Sample calculation of the physical quality index for rice seedlings, BRRI.

Seedling ht (cm)	Seedling [a] color rate (A)	Seedling strength (mg dry matter/cm) (B)	Seedling quality	
			(A) (B)	Index
11.1	5	8.97	44.9	100
11.1	5	7.57	37.8	84
10.1	4	5.51	22.0	49
10.3	4	4.11	16.4	36
9.2	2	6.33	12.7	28
8.9	2	4.20	8.4	18
9.0	1	3.50	3.5	8
9.8	1	2.65	2.55	6

[a] 5-1 : deep green - yellow.

Table 2. Relationships among seedling quality and grain yield, growth duration, and seedling strength. BRRI.

Season	Variety	Correlation coefficient [a]		
		Yield	Growth duration (days)	Seedling strength
Boro, 1980	BR3	–.522	–.727*	.927**
	BR7	–.006	–.233	.965**
Boro, 1981	BR3	.678	–.838**	.901**
	BR9	.376	–.834**	.963**
Aus, 1981	BR3	.439	–.305	.894**
Aman, 1981	BR4	.529	–.845**	.990**

[a] *significant at .05 level; **significant at .01 level.

Effect of planting time and density on yields of short-duration rice varieties

R. C. Gautam and K. C. Sharma, Agronomy Department, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar 263145, U.P., India

Field experiments during the kharif (wet) season 1975-77 at the Crop Research Centre (29° N lat, 79.3 E long, 243.84 m altitude) explored the effect of planting density and planting time on yields of short-duration rice varieties.

Ratna, Rasi, and Cauvery were evaluated under two planting schemes: a) 10 June sowing for all varieties and b) sowing on 20 June for Ratna, 5 July for Rasi, and 10 July for Cauvery. Jaya, a medium-duration high yielding variety, was planted 10 June as a check. Three planting densities, 400, 100, and 25 hills/m^2, were tested.

The short-duration varieties planted later responded better to high planting density (see table). Grain yields in high planting density (400 hills/m^2) increased over normal planting density (25 hills/m^2) by 10% in Ratna, 14% in Rasi, and 24% in Cauvery. These yields were compared with yields of medium-duration Jaya at normal planting density 2 of the 3 years of test. In 1976, a thunderstorm during ripening caused severe damage to the short-duration varieties at high planting density. The higher yields of short-duration varieties were ascribed to calm, cool, sunny weather during reproductive and ripening phases.

Effect of time of planting and plant density on average[a] grain yield of rice differing in growth duration in Pantnagar, India.

Variety and planting date	Grain yield (t/ha) at plant density: 400 hills/m^2	100 hills/m^2	25 hills/m^2	Mean (t/ha)
Jaya 10 June	6.7	7.3	7.2	7.08
Ratna 10 June	6.8	6.7	6.5	6.64
Rasi 10 June	6.2	6.0	5.7	5.98
Cauvery 10 June	5.8	5.5	5.0	5.43
Ratna 20 June	6.9	6.6	6.2	6.57
Rasi 5 July	6.8	6.3	6.0	6.36
Cauvery 10 July	6.2	5.6	5.0	5.57
Mean	6.5	6.3	6.0	–

Treatment	*S.Em.+*	*C.D. (P = 0.05)*
Planting time	0.12	0.37
Plant density	0.04	0.11
Plant density at same planting time	0.10	0.29
Planting time at same or different plant density	0.14	0.44

[a]Mean of 3 years.

Efficiency of green manure substituted for applied nitrogen in rice

C. S. Khind, O. P. Meelu, and Viraj Beri, Soils Department, Punjab Agricultural University (PAU), Ludhiana, India

Green manure crops were grown in 1979-81 to study their contribution to the nitrogen needs of a following rice crop.

Dhaincha, cowpea, and guara were sown in early May. The 2-month-old green-manure crops were buried 1 day before transplanting 45-day-old rice seedlings in early July.

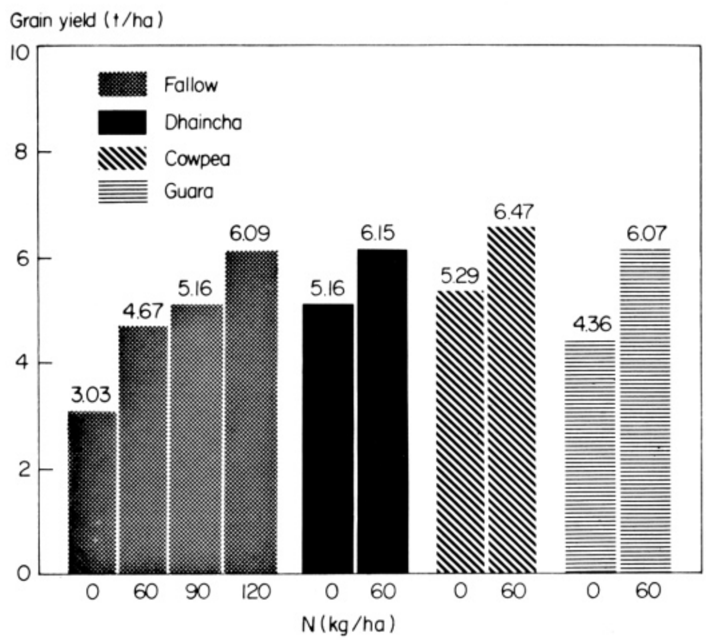
Green matter, dry matter, and nitrogen added by guara was less than that added by dhaincha and cowpea (see table). Dhaincha and cowpea saved 90 kg N/ha, guara saved 60 kg N/ha (see figure).

The combined use of 60 kg N/ha applied as urea and green manure gave as high a yield as did 120 kg N/ha as urea applied without a green-manure crop. This suggests that the green manures tested added about 50% of the nitrogen needed by rice.

Green and dry matter production and nitrogen added by green manures in Ludhiana, India.[a]

Green manure crop	Green matter (t/ha)	Dry matter (t/ha)	Nitrogen added (kg/ha)
Dhaincha	25	4.8	120
Cowpea	23	2.8	73
Guara	9	1.7	56

[a]Average of 3 years.



Effect of green manure plus nitrogen and nitrogen alone on yields in Ludhiana, India.

Cropping systems

Intraspecies intercropping of rice

B. N. Chatterjee and Shreemanta Bhattacharyya, Agronomy Department, B. C. Krishi Viswa Vidyalaya, Kalyani 741235, West Bengal, India

The effect of growing improved rice varieties of different growth durations as sole crops (Table 1) or of intercropping two varieties in alternate rows was measured. Experimental varieties were CRM13, IET2683, IET1444, IR579, IR36, and IR42. Days to maturity were from 74 to 142 days in the wet season and from 100 to 164 days in the dry. Row spacing was 20 cm, plant spacing was 10 cm.

The total intercrop yield increased linearly with differences in maturity of the intercropped varieties. The combination of IET2683 and IR42 gave the maximum grain yield (Table 2). The combined intercrop yield was greater than the sole crop yield for both varieties. The IET2683 and IR42 intercrop also gave the highest land equivalent ratio (Table 3). Compensation occurred in most cases, except in the IET2683 and IR42 combination where mutual cooperation existed. Mutual inhibition was observed with IR579 and IR42.

Yield advantages were not appreciable when maturity differences were less than 30 days. The correlation between grain yield and differences in maturity of two varieties in mixture was 0.72 in the dry season and 0.88 in the wet. When the maturity difference was greater than 40 days, the yield advantage decreased, probably because of the low yield potential of very early-maturing CRM13.

Increased intercrop yields were associated with the formation of more panicles. High competitive abilities were recorded in IR36 and IR42 in the wet season. In the dry season, IET2683 and IET1444 showed good competitive ability when they were cropped with a late-maturing variety.

Intraspecies intercropping yields were higher in the wet season than in the dry. These potential yield advantages will necessitate changes in harvesting practices. ■

Table 1. Grain yield of sole-crop rice cultivars with different maturities in West Bengal, India.

Variety	Wet season		Dry season	
	Maturity (days)	Grain yield (t/ha)	Maturity (days)	Grain yield (t/ha)
CRM13	74	1.3	100	2.7
ET2683	100	3.1	120	5.6
IET1444	109	3.4	124	5.6
IR579	122	3.3	129	5.5
IR36	129	3.3	134	5.5
IR42	142	3.3	164	5.5

Table 2. Grain yield of intercropped rice cultivars of different maturities in West Bengal, India.

Variety	Grain yield (t/ha)			
	Wet season		Dry season	
	Early variety	Late variety	Early variety	Late variety
CRM13 + IR36	0.6	2.7	1.3	3.3
CRM13 + IR42	0.6	2.8	1.3	3.6
IET2683 + IR36	2.0	1.6	2.9	2.3
IET2683 + IR42	1.9	2.5	3.5	2.7
IET1444 + IR36	2.0	2.0	3.3	2.4
IET1444 + IR42	1.8	2.3	3.4	2.6
IR579 + IR36	1.6	1.6	2.2	2.7
IR579 + IR42	1.5	2.0	2.8	2.5
IR36 + IR42	1.7	1.7	3.0	2.4
LSD (0.05)	0.63		0.59	

Table 3. Land equivalent ratio and competitive ratio under variety intercropping combinations. West Bengal, India.

Treatment	Land equivalent ratio (LER)[a]						Competitive ratio (CR)[b]			
	Wet season			Dry season			Wet season		Dry season	
	Early variety	Late variety	Total	Early variety	Late variety	Total	Early variety	Late variety	Early variety	Late variety
CRM13 + IR36	0.46	0.82	1.28	0.56	0.60	1.16	0.56	1.78	0.93	1.07
CRM 13 + IR42	0.46	0.85	1.34	0.48	0.64	1.12	0.52	1.85	0.75	1.33
IET2683 + IR36	0.65	0.48	1.11	0.52	0.41	0.93	0.53	0.74	1.27	0.79
IET2683 + IR42	0.63	0.76	1.39	0.62	0.49	1.11	1.35	0.68	1.26	0.79
ET1444 + IR36	0.53	0.70	1.23	0.59	0.43	1.02	0.80	1.32	1.38	0.73
ET1444 + IR42	0.59	0.70	1.29	0.60	0.47	1.07	0.84	1.19	1.28	0.78
IR579 + IR36	0.48	0.48	0.96	0.40	0.49	0.89	1.00	1.00	0.82	1.22
IR579 + IR42	0.45	0.61	1.06	0.50	0.45	0.95	0.75	1.35	0.67	0.90
IR36 + IR42	0.52	0.52	1.04	0.55	0.44	0.99	1.00	1.00	1.25	0.80

[a]Relative area of sole crop required to produce intercropping yield. [b]CR of *a* = LER crop *a*/LER crop *b*, and CR of *b* = LER crop *b*/LER crop *a*.

Management and productivity of farmers' boro rice

Md. Nazrul Islam Miah, M. Zahidul Hoque, and Peter H. Hobbs, Division of Rice Cropping Systems, Bangladesh Rice Research Institute, Joydebpur, Dacca, Bangladesh

In Bangladesh, spring (boro) rice is grown where surface or irrigation water is available. The crop is transplanted during the dry winter months of December and January and harvested during the hot spring months of April and May. In the river floodplains, irrigation is lifted by low lift pumps or by traditional swing baskets. In shallow terraced valleys and depressions with natural standing water, rice is sometimes double-transplanted as water recedes or is irrigated by low lift pumps and traditional irrigation equipment. In some highland areas without surface water, cultivation is dependent on tube well irrigation.

In recent years, as more pumps became available for irrigation in the dry season, a shift in rice cropping patterns has been observed, from the more risky, low-yielding deepwater aus rices in winter to the high-yielding boro varieties in spring.

A crop-cut study during 1975-76 boro assessed management level and yield of five improved varieties and two local varieties grown in the BRRI project area. Five-square-meter areas were harvested from 178 fields in 19 villages. The crop was threshed, cleaned, weighed, and moisture determined. Yield was converted to tons per hectare at l4% moisture. Information on fertilizer and insect and weed control was collected from farmers.

Average NPK application was greater on improved varieties than on local varieties. Farmers growing improved varieties used almost twice the amount of nitrogen as those growing local varieties. Most nitrogen fertilizer was applied in 3 splits: 30-40 kg as basal, 40 kg as first topdressing, and 30 kg as second topdressing.

Improved varieties outyielded local varieties (see table). Highest daily production was from IR9 and BR3. Generally, yields of improved varieties are higher in the boro season than in other seasons because of high solar radiation and low disease and pest incidence.

Most farmers did relatively good weeding, as is reflected by the weed control index at the time of harvest. About 60-70% used insecticides. Straw dry weight of IR9, Pajam, and Lathisail differed significantly from that of other varieties.

Management level and average yield of boro rice grown in BRRI Project area, Bangladesh, 1975-76.

Variety		Average rate of fertilizer $N\text{-}P_2O_5\text{-}K_2O$ (kg/ha)	Weed control index[a]	Farmers using pesticides (%)	Straw dry weight[b] (t/ha)	Average yield[b] (t/ha)	Yield range (t/ha)	Estimated yield/day[b] (kg/ha)
IR9	8	97-99-26	2.50	67	3.8 a	4.0 a	2.5-5.9	39.8 a
Pajam	18	U4-63-27	2.20	40	3.0 a	4.4 a	2.9-6.5	34.8 a
UR3	2	88-96-43	3.00	100	2.8 b	4.1 a	3.9-4.3	39.2 a
IR8	111	88-62-37	3.07	55	2.9 b	4.1 a	1.6-7.2	32.9 a
Chandina	14	85-68-48	3.10	64	2.1 c	3.6 a	9.8-5.6	37.7 a
Muktahar	18	43-44-30	2.83	53	2.8 b	2.1 b	1.2-3.2	20.6 b
Lathisail	7	43-30-26	2.00	0	3.5 a	1.9 b	0.7-3.3	17.6 b

[a]1 = excellent control, 5 = poor control. [b]In a column, figures followed by the same letters are not significantly different at the 5% level.

Machinery development and testing

Economic use of Japanese walking-type rice transplanters in Egypt

M. S. El-Keredy, Faculty of Agriculture kafr El-Seikh, Egypt

Two rice transplanting machines were used in a 1979-81 study comparing mechanical and hand planting. The two-row Mitsubishi MP 206 and the four-row Yanmar YP 400 transplanters are walking, handdriven types. The Japanese method of raising the seedlings in a wooden frame 370 × 114 cm containing

Table 1. Comparative yield components with direct seeding, hand, and mechanical transplanting at kafr El-Seikh, Egypt, 1979.

Planting method	Seeding rates (kg/ha)	Plant ht at harvest (cm)	Panicles (no./m²)	Panicle length (cm)	Branches (no./ panicle)	1,000-grain wt (g)	Yield (t/ha)
Direct seeding							
Broadcasting	95-144	131.6	488.9	22.01	7.60	24.0	7.08
Drilled	95-144	137.4	418.2	23.65	11.50	24.0	9.2
Transplanting							
Farmer by hand[a]	95-144	129.5	324	22.05	9.9	24.2	6.2
Recommended by hand[b]	95-144	139.3	380.4	23.28	11.12	26.6	9.1
Mechanical[c]	36-48	140.6	503.4	25.14	12.5	25.0	10.1

[a] The distance of farmer hand transplanting between hills and rows is not fixed. [b]Recommended hand transplanting density = 20 × 20 cm. [c]Mechanical transplanting density : MP 206 = 30 × 15 cm. YP 400 = 30 × 14 cm.

3 seedling mats measuring 360 × 28 × 3 cm was used. Seedling mats obtained from each frame are enough to transplant 1,000 m^2.

Seeds of cultivar Giza 172 were soaked at the same time for direct seeding, hand transplanting, and mechanical transplanting treatments. Seedling age was 2.5-3.5 leaves for mechanical transplanting, 5-6 leaves for recommended transplanting, and 6-7 leaves for traditional farmer transplanting. Water depth at transplanting was 3-4 cm for mechanical transplanting and 5-10 cm for hand transplanting.

Mechanical transplanting gave higher brown rice yields than traditional methods (Table 1). The high yield with mechanical transplanting could be explained by the high number of panicles per unit area and by larger, heavy panicles and vigorous growth. Vigorous young seedlings, a larger number of hills per unit area, and early machine transplanting caused the high yields in 1970 and 1980. The use in 1981 of rice transplanter YP 400 with its autohydraulic system increased efficiency.

The total cost of hand transplanting was 2.5 times greater than the cost of machine transplanting (Table 2).

Table 2. Cost for band and machine transplanting and yield of brown rice of Giza 172, kafr El Seikh, Egypt, 1980.

Planting method	(Cost[a] ($/ha)				Brown rice yield (t/ha)
	Initial cost to transplant 1 ha	Wooden frame	Seed	Total	
Hand transplanting	102.87		12.00	116.91	4.3
Machine transplanting (MP 206)	44.00	2.77	5.14	52.00	11.8
Av yield in Egypt					6.2

[a]Converted at the rate of US$1 — Egyptian pound 0.70

Announcement

First IRRI trustee president dies

The first president of IRRI's Board of Trustees, Dr. J. George Harrar, died 18 April 1982 at his home in Scarsdale, New York, USA. DR. Harrar, a biologist, was often credited with initiating the increase in agricultural productivity in developing nations that is known as the "green revolution."

The former president of the Rockefeller Foundation was one of' five original members of the corporation that established IRRI in 1960-61. The international agricultural research centers now encompass a global network of 13 institutions that in 1981 received more than $120 million from nations and agencies committed to international agricultural development.

The recipient of some 30 honorary degrees from universities in the United States and abroad, Dr. Harrar also was decorated by the governments of' Mexico, Thailand, Colombia, and Chile. He was the author of some 60 professional papers in phytopathology and mycology and publishcd 50 articles on world agriculture, food and population, higher education, environmental quality, and nutrition. He also authored or co-authored 3 books, the last *Strategy for the Coquest of Hunger* in 1967.

With Rockefeller Foundation from 1943 until his retirement in 1972, He was a leader in the application of scientific methods to raise the quality and quantity of food. Under his administration as president and trustee of the Foundation, almost $400 million was appropriated to carry forward projects to increase productivity of basic food crops, to reduce population growth rates, to develop universities, to bring about equality of opportunity for minorities, to foster the performing arts, and to improve the quality of the environment.

In 1980, the original scholar and training building complex at IRRI was dedicated as J. George Harrar Hall in honor of his contribution to the Institute.

J. George Harrar Hall, IRRI's original scholar and training building complex decicated in 1980. Inset, Dr. Harrar during his tenure as the first president of IRRI's Board of Trustees.

The International Rice Research Institute
P.O. Box 933, Manila, Philippines

ISSN 0115–0944