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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 the following 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 abbreviations other than for units of measure, spell out the full name the first time of reference, with abbreviations 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 intervals; 7%; 4 hours.
- Write out number 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 informatlon (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 U.S. rice varieties in Afghanistan

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

Thirty-seven U.S. rice varieties were tested in observational nurseries at agricultural research stations at Baghlan in the Northern Zone (temperate climate) and at Jalalabad in the Eastern Zone (subtropical climate) in 1966. Thirteen varieties at Baghlan and 24 varieties at Jalalabad grew normally.

In replicated variety trials in 1966-80 under high fertility (120-80-60 kg NPK/ha), 11 varieties appeared promising at both sites. Local fine-grained varieties Barah at Baghlan and Pashadi at Jalalabad, and coarse-grained variety Luk at both sites were included as checks.

Yields of both fine-grained and coarse-grained U.S. varieties were higher at Baghlan than at Jalalabad (Table 1). At Baghlan, average yields of fine-grained varieties varied from 6.2 t/ha for Starbonnet to 7.8 t/ha for CI 9453 B_6T_{50} × CI 9187, 9.69-49.11% more than local variety Barah.

Yields of coarse-grained varieties ranged from 6.5 t/ha for Belle Patna to 8.1 t/ha for Arkrose, 50-128% more than the local variety.

At Jalalabad, fine-grained variety yields ranged from 3.1 t/ha for CI 9153 B_6T_{50} × CI 9810 to 5 t/ha for Starbonnet, 15-44% more than the local variety.

Table 1. Yields of U.S. rices in varietal trials at the agricultural research stations at Baghlan and Jalalabad, Afghanistan, 1966-80.

Variety	Trials (no.)	Average yield (t/ha)		Increase over local variety	
		U.S. variety	Local variety	t/ha	%
Baghlan					
Fine-grained varieties					
CI 9453B_6T_{50} × CI 9187	10	7.8	5.2	2.6	49
Della	10	7.6	5.6	2.0	36
Kolo Australia	10	7.4	5.0	2.4	49
R7689x (7P × RSBR)	2	7.1	6.4	0.6	10
Saturn	20	6.7	5.4	1.3	23
CI 9453B_6T_{50} × CI 9810	2	6.6	5.6	0.9	16
Starbonnet	2	6.2	5.6	0.6	11
Coarse-grained varieties					
Arkrose	14	8.1	3.5	4.6	128
Northrose 9407	3	7.6	4.6	3.0	65
Calrose	3	6.6	4.0	2.5	63
Belle Patna	4	6.5	4.4	2.2	50
Jalalabad					
Fine-grained varieties					
CI 9453B_6T_{50} × CI 9187	5	5.0	3.6	1.3	37
Della	6	3.6	3.2	0.5	15
Kolo Australia	5	4.5	3.3	1.1	33
R7689x (7P × RSBR)	3	4.9	3.5	1.4	39
Saturn	7	3.4	2.4	0.8	33
CI 9453B_6T_{50} × CI 9810	2	3.1	2.5	0.6	24
Starbonnet	2	5.0	3.4	1.5	44
Coarse-grained varieties					
Arkrose	8	4.4	2.9	1.4	50
Northrose 9407	3	5.9	3.5	2.4	68
Calrose	5	4.3	3.2	1.1	33
Belle Patna	4	3.4	1.5	1.9	122

Table 2. Quality characters of 2 promising U.S. varieties and the quality rice varieties of Afghanistan.

Variety	Origin	Grain appearance			Alkali spread	Gelatinization temperature	Gel consistency (mm)	Amylose (%)	Aroma
		Length	Shape	Chalkiness					
Saturn	USA	Long	Slender	None	4.5	Intermediate	55	21.5	Slight
Della	USA	Extra long	Slender	Small	7.0	Low	100	18.8	Slight
Barah	Afghanistan	Extra long	Slender	Small	6.4	Low	32	22.7	Moderate
Pashadi	Afghanistan	Long	Slender	Large	5.5	Intermediate	60	20.4	Moderate

Coarse-grained variety yields ranged from 3.4 t/ha for Belle Patna to 5.9 t/ha for Northrose 9407, 33-122% more than the local variety.

In evaluation of the fine-grained varieties at IRRI, the quality characters of Saturn and Della compare well with those of local varieties (Table 2). U.S. variety Saturn was better than the best quality variety of Afghanistan and has become very popular with farmers in the Northern Zone. In the Eastern Zone, it could not compete with the Indian quality rice variety CR44-11 already being grown.

Local coarse-grained variety Luk is being replaced with Arkrose and Northrose in the Northern and Eastern Zones, where they have yield potentials up to 8.1 t/ha and 6.0 t/ha.

Scanning electron microscope studies of the structure and the initial germination stages of rice seed

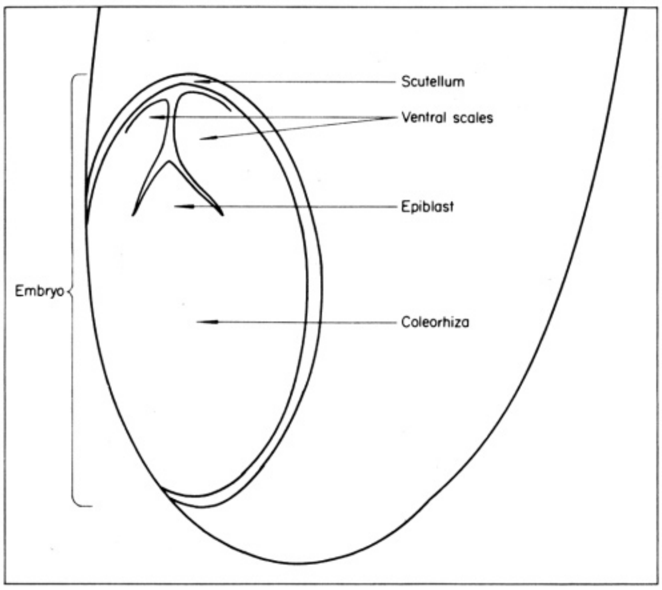
S. Y. Zee, Botany Department, University of Hong Kong, and Hsu Hsue-Pin and Han Hui-Zhen, South China Agricultural College, Kwangchow, China

In China, experienced farmers sow pre-germinated seed at the white exposed or Lou Bai stage. The scanning electron microscope was used to determine the structural features of seeds at Lou Bai and to study early stages of rice seed germination.

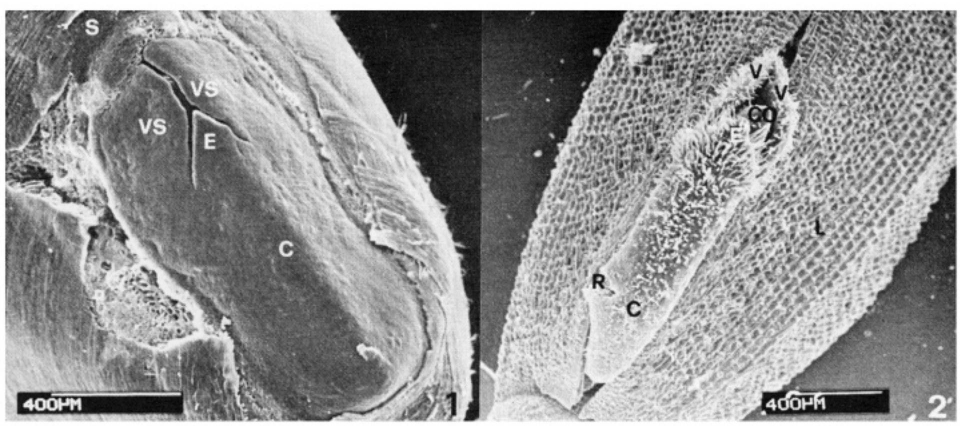
Before germination starts the mature embryo of rice consists of a number of embryonic leaves enclosing an apical meristem and a radicle. The embryonic leaves are enclosed by a cylinder-like covering, the coleoptile. Toward the dorsal side of the caryopsis, between the embryo and the endosperm, is the scutellum. Opposite the scutellum, on the ventral side of the caryopsis, are several interconnecting structures — two scales, the epiblast and the coleorhiza (Fig. 1).

These ventrally located structures are masked by the seed coat and the pericarp of the caryopsis. The two ventral scales originating from the scutellum are free from each other on the ventral side but overlap slightly as they curve inward toward the scutellum.

The two ventral scales and the epiblast enclose only the top half of the embryo, the coleoptile. The bottom half



1. Ventral view of a rice seed embryo after removal of the seed coat and the pericarp.



2. Ventral view of a rice seed embryo at Lou Bai or white exposed stage, about 60 hours after germination. C = coleorhiza, CO = coleoptile, E = epiblast, L = lemma, R = radicle, VS = ventral scales, s = scutellum. Seeds were germinated on wet filter paper in a lighted room at ambient temperature before critical point drying. Specimens were observed in a Cambridge Stereoscan microscope operating at 20 KV. The rice variety was Gui Chao.

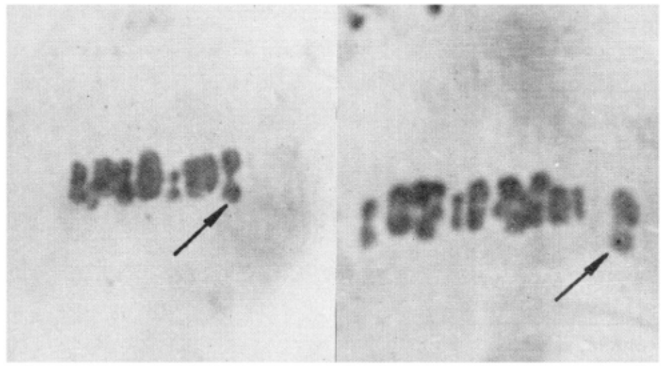
of the embryo is sheathed in the coleorhiza. Where the coleoptile tip is situated, the epiblast and the ventral scales meet to form an inverted Y-shaped gap not unlike a germination pore.

Prior to the emergence of the radicle or coleoptile, the ventral scales, the epiblast, and the coleorhiza swell, rupturing the seed coat, the pericarp, and the lemma. At about 36 hours of germination, the ventral scales, the epiblast, and the coleorhiza begin to give rise to a large number of epidermal hairs. At about 48 hours of germination, the coleoptile begins to protrude through the inverted Y-shaped gap between the ventral scales and the epiblast.

At about 60 hours, the radicle begins to push through the coleorhiza (Fig. 2). At this stage, the seeds are ready for sowing.

Cytogenetic variation in brown planthopper biotypes 1 and 2

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

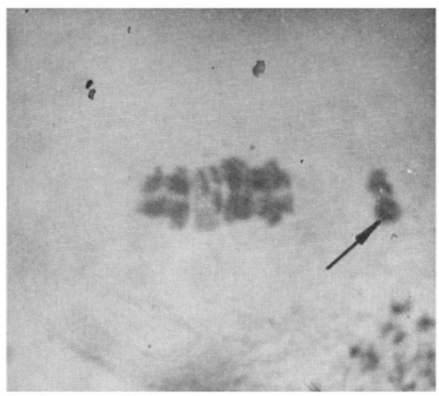


1. Metaphase 1 chromosomes in testicular cells of brown planthopper biotype 1 males. (Sex chromosomes are indicated by arrows.) IRRI, 1981.

Chromosome number, morphology, and behavior often are used as complementary taxonomic indicators in species complexes. Sex chromosomes are especially useful in cytotaxonomy because they can show marked and subtle differences within a genus or a species. Cytogenetic investigations of the meiotic chromosomes of brown planthopper (BPH) biotype 1 and 2 populations maintained as stock cultures at IRRI show that the first division of meiosis is reductional and the second equational for all components of the species' genome.

The male diploid number, determined to be 2n = 30, consisted of 14 bivalent autosomal pairs and XY sex chromosomes. *Nilaparvata lugens* (Stal) has an XY sex determining mechanism, with the males heterogametic (1411 + XU) or producing two types of secondary spermatocytes and the females homogametic (1411 + XX) or producing only one type of secondary oocytes.

Chromosomal behavior during metaphase 1 featured the clustering of highly condensed and shortened autosomes at the equatorial portion of the reproductive cell and separation of the highly heterochromatic, unequally synapsed sex chromosomes from the autosomal grouping. The clustering of autosomes is due mainly to intrachiasmatic and inter-Chiasmatic matrices between the homologous bivalent chromosomes and among the tetrads or homologues.



2. Metaphase 1 chromosomes in a testicular cell of brown planthopper biotype 2 male. (Sex chromosome is indicated by arrow.) IRRI. 1981.

Metaphase 1 stages in testicular cells from 60 newly emerged males each of BPH biotypes 1 and 2 were examined. In 218 biotype 1 cells, 147 (68%) showed complete aggregation of sex chromosomes with autosomes. The rest of the cells revealed slight separation of sex chromosomes from the autosomes. Almost 100% of 200 metaphase 1 chromosomes observed for biotype 2 manifested complete isolation of the sex chromosomes from the autosomal groupings.

The sex chromosome is more isolated from autosomes in biotype 2 than in biotype 1. The extent of chromosome clumping also was higher in biotype 2 than in biotype 1 (Fig. 1, 2). The occurrence of such chromosomal aberrations as loose pairings of paired homologous bivalents as well as fragmentations or chromosomal deletions were more frequent among biotype 1 than biotype 2 chromosomes. Further cytogenetic studies are in progress.

GENETIC EVALUATION AND UTILIZATION

Grain quality

Cooking and milling quality of Spanish rice varieties and breeding lines

R. Carreres, ingeniero agronomo, Departamento del Arroz, lnstituto Nacional de Investigaciones Agrarias, Sueca (Valencia), Spain

Seven rice varieties grown on more than 90% of the rice area in Spain and 2 good grain quality rice hybrids were evaluated for milling and cooking quality. The varieties and breeding lines were grown using current Spanish culture methods in 3- × 3-m plots in a 3 × 3 balanced lattice design.

The varieties and breeding lines were classified by the Recommended Model

Grading System for Rice International Trade (Table 1) as:

Long size grains and bold shape: Italpatna, Bahia/ IR52-21A, Betis, and Gema/ Sequial96:

Medium size grain and round shape: Bahia, Niva, Jucar, and Balilla/Sollana;

Medium size grain and bold shape: Sequial.

All varieties and breeding lines had low amylose content (<20%) and high alkali spreading value (6-7 when immersed in 11 ml of 1.4% KOH) (Table 2). Bahia/IR52-21A has very good eating quality (N index) related to high cooking stability.

Cooked grains of Italpatna, Gema/ Sequial 96. and Bahia/ lR52-21 A had the stability and cohesiveness for the best eating quality.

Table 1. Milling quality and grain characteristics of some rice varieties grown in Spain.[a]

Variety	Grain size and shape (milled rice)				Milling yield	
	Length (mm)	Width (mm)	Thickness (mm)	Length-width ratio	Whole kernel (head) rice (70)	Total milled rice (%)
Bahia	5.5 a	3.0 a	2.1 a	1.8 a	57.3 a	68.9 ab
Sequial	5.4 a	2.7 b	1.8 b	2.0 b	59.6 a	70.4 c
Niva	5.4 a	2.9 c	2.0 c	1.9 a	59.3 a	69.5 a
Júcar	5.4 a	2.9 c	2.0 c	1.8 a	58.3 a	67.2 d
Balilla/Sollana	5.1 b	3.1 d	2.1 a	1.7 c	57.8 a	67.0 d
Italpatna	6.5 c	2.5 e	1.8 b	2.6 d	48.5 b	68.3 bc
Betis	6.2 d	2.6 f	1.8 d	2.3 e	61.2 a	69.5 a
Gema/Sequial 96	6.4 c	2.7 b	1.8 d	2.3 e	56.7 a	68.7 b
Bahia/IR52-21A	6.1 d	2.9 c	2.0 c	2.1 f	50.8 b	67.7 de

[a] Means of 4 replications. In a column, values with common letters are not significantly different from each other at the 5% level.

Table 2. Cooking and eating qualities of some rice varieties grown in Spain.[a]

Variety	Amylose content (% d.b.)	Alkali spreading value	N index[b]	Gelatinization time (min)	Water uptake (mg/mm^2)	Elongation ratio (%)	Eating quality characteristics[c]		
							Cohesiveness	Acceptability	Stability (not fracturability)
Bahia	19.4 ab	6.0 ab	806 d	17.7 a	1.3 ab	54.5 a	8 a	6 a	6 a
Sequial	18.5 b	5.4 c	662 a	16.6 b	1.2 b	38.0 c	8 a	6 a	6 a
Niva	19.8 ab	6.0 ab	751 c	17.7 a	1.2 b	50.5 b	8 a	5 a	5 a
Júcar	19.3 ab	6.1 ab	812 d	16.9 b	1.2 b	53.7 a	8 a	6 a	6 a
Balilla/Sollana	20.5 a	6.2 a	708 b	17.1 b	1.3 ab	49.4 b	8 a	6 a	4 a
Italpatna	18.7 b	6.1 ab	740 c	15.0 c	1.3 ab	39.6 c	9 b	8 b	8 b
Betis	17.2 c	5.9 ab	800 d	15.3 c	1.3 b	33.3 d	8 a	5 a	5 a
Gema/Sequial 96	17.2 c	5.9 b	792 d	15.4 c	1.2 b	30.5 e	9 b	8 b	8 b
Bahia/IR52-21A	20.1 a	5.9 ab	921 e	18.4 d	1.4 a	53.9 a	9 b	8 b	8 b

[a] Means of 4 replications. In a column, values with common letters are not significantly different at the 5% level [b] Absorbance at 550 nm of alkali-soluble proteins of whole grain rice by biuret test per gram of rice; protein content of the outermost layer, extracted by alkali. [c] Scale 1 to 9 is adopted with 9 = highest intensity character.

GENETIC EVALUATION AND UTILIZATION

Disease resistance

Reaction of rice varieties to stem nematodes in Vietnam

Dang-ngoc Kinh, Nguyen-thi Nghiem, and senior students, Plant Protection Department, University of Cantho, Hau Giang, Vietnam

The coleoptile inoculation method, with 10 adult nematodes *(Ditylenchus angustus)* per germinated seed, was used to screen 1,197 varieties and cultivars in 1979-81. After inoculation and 48-hour incubation in a moisture-saturated atmosphere at 28-30° C, 40 seedlings of each variety were transplanted at 10 seedlings/ pot. Pots were placed in a partly shaded screenhouse, 80-90% relative humidity, and 28-30°C temperature.

Degrees of infestation were classified 30 days after inoculation as very slight (disease incidence below 20%)., slight (20-40%), moderate (41-60%), severe (61-80%), and very severe (over 80%).

Of 34 deepwater varieties, 3 had slight, 24 moderate, and 7 severe infestation.

Of 22 rainfed varieties, 2 had very slight, 4 slight, 10 moderate, and 6 severe infestation.

Of 145 early maturity local varieties, 4 had slight, 107 moderate, 31 severe, and 3 very severe infestation.

Of 368 medium maturity local varieties, 3 had very slight, 79 slight, 175 moderate, 104 severe, and 7 very severe infestation.

Of 502 late maturity local varieties, 7 had very slight, 94 slight, 274 moderate, 126 severe, and 1 very severe infestation.

Of 126 high-yielding improved varieties or cultivars, 4 had very slight infestation (IR9 129-393-3-1-2, IR9 129-169-3-2-2, IR9224-117-2-3-1 and IR2307-247-2-2-3). The rest had moderate to very severe infestation.

Yield loss due to bacterial leaf blight

M. P. Srivastava, extension plant pathologist, Haryana Agricultural University, Hissar, India, and T. R. Kapoor, district extension plant protection specialist, Farm Advisory Centre, Kurukshetra, Haryana, India

Bacterial blight damage was assessed in a field planted with variety Jaya in Gobindgarh village, Kurukshetra district, during 1981 kharif. The first blight symptoms were observed on 17 August. The disease continued to spread until the first week of September. Plants with different grades of infection by the Standard Evaluation System for Rice were tagged the last week of August at 4–5 growth stage of the crop. For each disease grade, 100 hills were harvested and yield was compared with yield from 100 healthy hills (see table). Yield loss occurred even at infection grade 1 and increased with grade of infection.

Yield differences in bacterial blight-infected rice in Haryana, India.

Infection grade	1	3	5	7	9
Yield loss (%)	6.3	12.3	21	31.6	36.8

Potential sources of blast resistance for hilly regions in India

J. P. Tandon, director, and J. C. Bhatt, scientist S-1, Plant Pathology, Vivekananda Parvatiya Krishi Anusandhan Shala, Almora, U.P., India

Extensive screening for blast resistance in 1978-81 included more than 1,400 local hill rices, about 2,000 improved strains and promising advanced generation bulks from various research centers within India, and about 1,200 cultures from the International Rice Testing Program (IRTP), including the International Rice Blast Nursery (IRBN). Natural disease pressure is always extremely high at the experimental farms where screenings were carried out.

High tolerance materials from the preliminary screenings were tested under artificial epiphytotic conditions. Selected materials were also tested at Pithoragarh, Bhowali, Majhera, and Palampur in 1981. All promising entries were tested for neck blast reaction under Almora conditions.

Nineteen entries scored 2 or below (Standard Evaluation System for Rice) at more than 70% of the locations where IRBN has been tested under the IRTP, and conform to the requirements for potential sources of resistance for both leaf and neck blast. IR9292-21–1, VL8, Milyang 46, IR5908-84-2-3-3, IR5931-81-1-1, IR5031-P1p-4B, IR5908-84-2-2, Toride I, and Wagwag combine high blast resistance with medium short maturity and fair cold tolerance. Tapoo-choz, Camponi SML, Colombia 11, Dissihatif (73127), IR4547-6-2-5, and RP 1057-35-I-I have medium late maturity and some degree of cold tolerance. Tetep, IR1544-238-2-3, IR3273-339-2-5, and IR1416-128-5-8 also have high tolerance for sheath rot and leaf scald diseases. Except for IR3273-339-2-5, all the listed IR varieties seem to derive their resistance from Tetep.

VL8, Milyang 46, and IR9202-21-1 showed a combination of desirable agronomic features in addition to blast resistance. VL8, a japonica type with some tolerance for *Helminthosporium* disease and some insect pests, is already on the list of released varieties for the hilly regions of Uttar Pradesh. Sufficient quantities of seeds are being produced for immediate use.

Evaluation of rice cultivars for resistance to blast and brown spot diseases

S. Sannegowda and K. T. Pandurangegowda, Plant Pathology Department, University of Agricultural Sciences, Regional Research Station, V. C. Farm, Mandya, Karnataka, India

National Screening Nurseries (NSN) 1 and 2 and the International Rice Blast Nursery (IRBN) trials during 1981 kharif at Mandya evaluated 954 cultivars for resistance to leaf blast, neck blast, and brown spot diseases. Reactions were recorded under nursery and transplanted conditions.

Of 386 cultivars screened in NSN 1, 31 showed combined resistance for leaf blast, neck blast, and brown spot. Only 17 entries in NSN 2 and 17 in the IRBN trial showed combined resistance.

GENETIC EVALUATION AND UTILIZATION

Insect resistance

An improved oviposition cage for rice stem borers

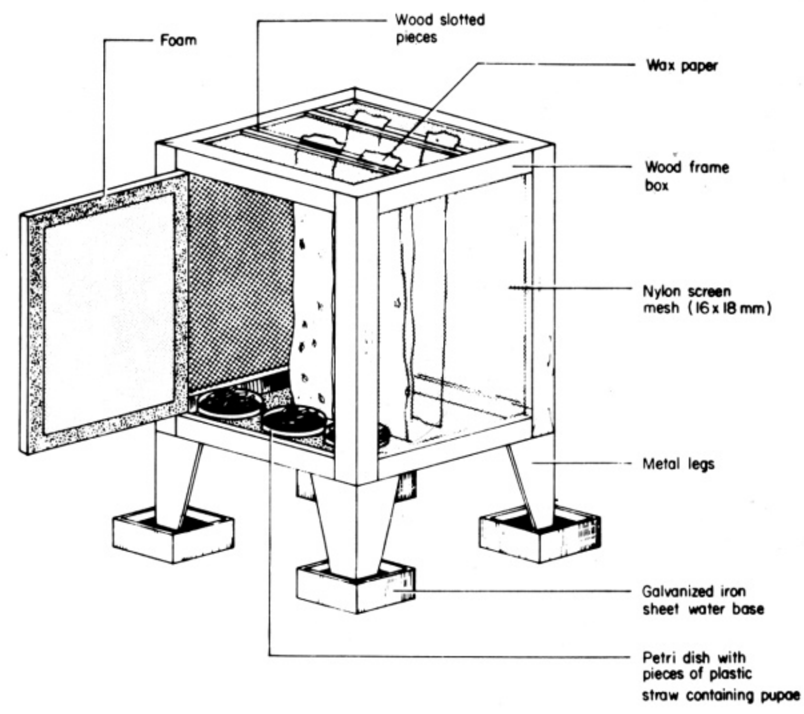
Frank M. Davis and Carlos R. Vega, International Rice Research Institute, Los Baños, Philippines

In the old oviposition cages used to collect stem borer egg masses at IRRI, many of the egg masses were laid on cage surfaces other than the one designated for oviposition. A new oviposition cage was constructed to force female moths of *Chilo suppressalis* (Walker), *C. polychrysus* (Meyrick), and *Tryporyza incertulas* Walker to oviposit on the desired substrate.

The cage (see figure) consists of a wooden frame 45 cm wide × 52 cm high covered with nylon screen. The cage bottom is wood. Common air conditioner foam rubber filter is stapled on intercage wood surfaces.

The preferred oviposition substrate of wax paper strips (15.24 cm wide × 60.96 cm long) are held in place vertically by slipping the paper through slots in wooden slots at the top and bottom of the cage and securing with tape. Slots are partitioned 12.5 cm apart.

C. suppressalis and *C. polychrysus* pupae in petri dishes were placed in the cage. Female adults that emerged within the cage were observed to oviposit only on the wax paper. *T. incertulas* moths collected around light sources laid 80% of their egg masses on the wax paper.



An improved oviposition cage for rice stem borers, developed at IRRI.

Varietal reaction to rice gall midge

S. Uthamasamy, P. Karuppuchamy, and G. Chakkaravarthy, Tamil Nadu Rice Research Institute, Aduthurai-612 101, Tamil Nadu, India

Field resistance to rice gall midge *Orseolia oryzae* was assessed during 1981 kharif on prerelease cultivars and recommended varieties at Aduthurai. Test varieties were grown in 20-m^2 plots replicated 3 times. Recommended agronomic practices were followed except no insect control was used.

Gall midge damage was assessed 60 days after planting as the number of silver shoots among total tillers in 10 hills selected at random from each plot. Rating was by the Standard Evaluation System for Rice.

Of the entries tested only IET3231 had no damage. Five entries recorded less than 5% damage (see table).

Gall midge damage at Tamil Nadu, India, 1981 kharif.

Variety	Parentage	Duration (days)	Damage (%)	Rating
IET3231	IR8/Siam 29	135	0.0	0
IET6010	IR8/W1263	127	0.5	1
IET6290	Leaung/IR8	135	0.8	1
IET6282	Leaung/IR8	130	4.4	3
IET6074	Vijaya/Ptb 21	130	2.3	3
IET5975	OR 10-135/W1263	130	5.0	3
IR20	IR262/TKM6	135	9.1	5
Jaya	TN1/T141	125	9.8	5
Jagannath	Mutant of T141	150	18.0	7
Pankaj (susceptible check)	Peta/Tongai Rotam	150	34.7	7
CD			11.66	

Gall midge collections needed

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

Discrepancies in reports on host ranges and other biological information on *Orseolia oryzae* in Asia and Africa indicate a need for basic taxonomic research. Such research must be based on adequate collections of reared series from cultivated rice and from suspected wild grass hosts.

The materials needed include adult males and females with associated larvae, pupae, and pupal cases; data on host plant species and cultivars; type of gall or other damage; locality and date of collection.

Specimens may be preserved by collecting into tubes of 70-80% alcohol. Movement of specimens within the tubes should be limited by inserting small pieces of polythene film or tissue paper (*not* cotton-wool as it catches on claws and spines). Examination of representative series easily acquired from laboratory cultures will provide a check on culture identity.

Collections should be sent by air or sea mail *(not* air freight) to: K. M. Harris, Commonwealth Institute of Entomology, c/o British Museum (Natural History), Cromwell Road, London SW7 SBD, UK.

Yellow stem borer damage to rice varieties in the Punjab, India

G. S. Dhaliwal and Jaswant Singh, Punjab Agricultural University, Rice Research Station, Kapurthala-14460I, Punjab, India.

Activity of the yellow stem borer *Scirpophaga incertulas* (Walker), a pest of tall basmati type varieties in the Punjab, was suppressed with the introduction of high-yielding dwarf varieties. But recently serious infestations have appeared in localized pockets, particularly in Ferozepur district.

Five promising rice varieties were grown in 500 m^2 plots at different sites as farmers' field trials. PR106 and PR107 are high-yielding dwarf varieties; IET4141 is resistant to bacterial leaf blight and sheath rot; Basmati 370 is a traditional tall, scented variety, and Bauni Basmati is a fine-grained, scented dwarf variety.

Incidence of deadhearts and whiteheads from 20 random hills was recorded 60-70 days after transplanting and 10-15 days before harvest. Damage to Basmati 370 was most severe (see table).

Incidence of yellow stem borer on rice varieties at different sites in the Punjab, India, 1981 kharif.[a]

Variety	Cross	Duration (days)	Deadhearts (%)					Whiteheads (%)				
			Sodhi Nagar	Hamad	Bajeke	Mamdot	Av	Sodhi Nagar	Hamad	Bajeke	Jhoke Harihar	Av
Basmati 370	Pure line selection	145-155	32.4	15.2	NP	16.0	21.2	9.6	46.0	NP	NP	27.8
Bauni Basmati	Sona/Basmati 370	145-155	28.0	9.5	NP	9.1	15.7	5.8	32.4	NP	NP	19.0
IET4141	IR8/BJl//IR22	145-155	28.0	NP	1.24	NP	14.0	8.7	NP	10.6	7.4	8.9
PR107	Jaya/Palman 579	140-145	4.9	1.1	0.67	1.3	2.0	1.9	16.8	3.2	1.1	5.8
PR106	IR8//Peta 5/Belle Patna	140-145	1.7	0.3	0.00	0.7	0.7	2.9	3.8	9.3	4.0	6.1

[a] NP = variety not planted at the site.

Resistance of IR varieties to insect pests

E. A. Heinrichs, F. Medrano, L. Sunio, H. Rapusas, A. Romena, C. Vega, V. Viajante, D. Centina, and I. Domingo, International Rice Research Institute

Rice varieties IR5 to IR54 were evaluated for resistance to hoppers, leaffolder, and caseworm in greenhouse tests; striped and yellow stem borer in the screenhouse; and whorl maggot in the field. Damage ratings were based on the Standard Evaluation System for Rice.

All IR varieties except IR22 showed resistance to at least one insect (see table). Although none of the varieties are resistant to the zigzag leafhopper and leaffolder, resistant donors have been identified and are being utilized in breeding programs.

Individuals, organizations, and media are invited to quote or reprint articles or excerpts from articles in the IRRN.

Resistance of IR varieties to insect pests,[a] **IRRI, 1981.**

Variety	Brown planthopper			Green leaf hopper	White backed plant-hopper	Zigzag leaf-hopper	Yellow stem borer	Striped stem borer	Leaf-folder	Case-worm	Whorl maggot
	Biotype 1	Biotype 2	Biotype 3								
IR5	S	S	S	MR	S	S	S	S	S	S	S
IR8	S	S	S	MR	S	S	S	S	S	S	S
IR20	S	S	S	MR[d]	S	S	MR	R	S	S	S
IR22	S	S	S	S	S	S	S	S	S	S	S
IR24	S	S	S	MR	S	S	S	S	S	S	S
IR26	R	S	R	MR	S	S	S	MR	S	S	S
IR28	R	S	R	R	S	S	S	S	S	S	S
IR29	R	S	R	R	S	S	S	S	S	S	S
IR30	R	S	R	R	S	S	S	MR	S	S	S
IR32	R	R	MR[c]	MR	S	S	S	MR	S	S	S

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TABLE CONTINUED

Variety	Brown planthopper			Green leaf-hopper	White-backed plant-hopper	Zigzag leaf-hopper	Yellow stem borer	Striped stem borer	Leaf-folder	Case-worm	Whorl maggot
	Biotype 1	Biotype 2	Biotype 3								
IR34	R	S	R	R	S	S	S	MR	S	S	S
IR36	R	R	MR[c]	MR	S	S	MR	R	S	S	S
IR38	R	R	MR[c]	MR	S	S	S	MR	S	S	S
IR40	R	MR	S	MR	S	S	MR	R	S	S	MR
IR42	R	R	S	MR[d]	S	S	S	MR	S	S	S
IR43	S	S	S	MR	S	S	S	MR	S	S	S
IR44	R	R	MR[c]	MR	S	S	S	R	S	S	S
IR45	R	S	R	MR	S	S	S	S	S	S	S
IR46	R	S[b]	R	MR[d]	S	S	S	S	S	S	S
IR48	R	R	S	MR	MR	S	S	S	S	S	S
IR50	R	R	MR[c]	R	S	S	MR	R	S	S	S
IR52	R	R	MR[c]	R	MR	S	S	MR	S	S	S
IR54	R	R	S	R	S	S	MR	MR	S	S	S

[a]Replicated experiments. Hopper resistance based on greenhouse evaluation of seedlings; yellow and striped stem borer resistance based on screenhouse evaluation of 40- to 70-day-old plants; leaffolder and caseworm resistance based on the reaction of 30- and 11-day-old plants in the greenhouse; whorl maggot resistance based on field observations at 30 days after transplanting. Ratings, based on Standard Evaluation System for Rice: 1-3 = resistant (R), 5-7 = moderately resistant (MR), and 9 = susceptible (S). [b]IR46 has field resistance to biotype 2. [c]Reactions to biotype 3 vary, occasionally susceptible and often resistant. [d]Occasional susceptible reactions.

GENETIC EVALUATION AND UTILIZATION

Deep water

Vegetative regeneration in floating rice

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Two types of cuttings and two planting methods were used to study vegetative regeneration for retrieval of floating rice plants. Healthy stems were cut into sets, with two open nodes in top cuttings and two to three nodes in mid-stem cuttings. Cuttings were planted both vertically and horizontally.

Top cuttings (48) with just-sprouting and developed aquatic roots were planted in submerged soil (20 cm water) 10 cm apart in vertical planting, and end-to-end in horizontal planting with 20 cm interrow spacing. Unsprouted mid-stem cuttings (48) were inserted straight in vertical planting and planted in furrows in horizontal planting.

In top cuttings, dormant buds sprouted on day 5 and tillers were seen after 1 week. In horizontal planting, the middle bud sprouted at a 75-98° angle. In vertical planting, shoots emerged from the lower and middle buds parallel to the cutting.

Sets were transplanted 1 week after emergence and waterlogging was maintained. Performance of the regenerated plants was compared with that of normal plants (see table).

Survival was highest with vertical planting. Yield characteristics were very low, but might be improved by adjusting planting time.

Performance of floating rice stem cuttings and normal plants at Ghaghraghat, India.

Treatment	Survival (%)	Plant height (cm)	Tillers/ plant (no.)	Panicle length (cm)	Grains/ panicle (no.)	Sterility (%)	Flag leaf area (cm^3)	100-grain weight (g)	Yield per Plant (g)
Stem - top cuttings, developed roots, planted vertically	82.5	94.0	8.6	22.6	118	18.1	12.7	2.2	4.0
Stem - top cuttings, developed roots, planted horizontally	79.1	91.1	6.8	21.5	107	20.4	19.1	2.2	3.4
Stem - top cuttings, sprouted roots, planted vertically	79.1	93.8	6.4	21.3	99	19.8	16.5	2.2	3.3
Stem - top cuttings, sprouted roots, planted horizontally	82.5	86.7	4.0	22.5	105	20.5	16.6	2.2	3.5
Mid-stems planted vertically	73.7	83.3	6.3	19.3	105	25.4	17.6	2.1	2.7
Mid-stems planted horizontally	58.8	90.6	5.6	22.2	104	25.6	15.3	2.1	2.0
Normal plant	-	425.0	10.4	27.4	154	15.3	24.1	2.5	28.6

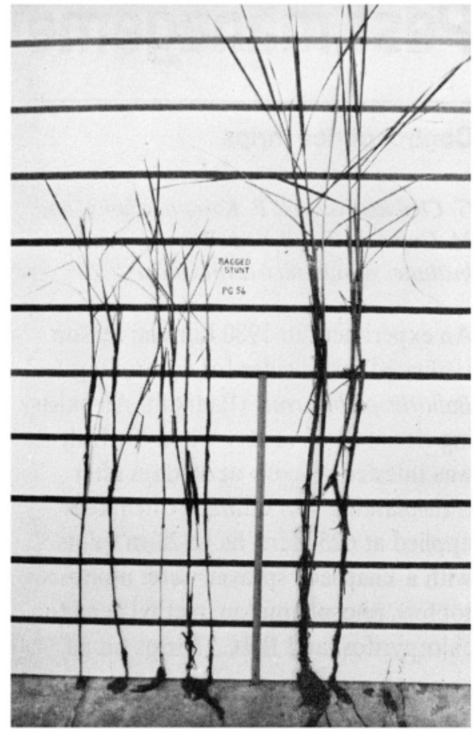
Incidence of ragged stunt in floating rice in Thailand

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

Severe outbreaks of ragged stunt virus disease (RSV) occurred in floating rice in the Central Plains of Thailand in 1981. Infected plants showed the disease symptoms typically associated with paddy rice—dark green and ragged leaves, spirally twisted leaves, severe stunting (see figure) with occasional bunched growth from an upper node, and incomplete panicle emergence with unfilled grains. Infection was widespread in the deepwater rice areas, particularly in Nakhon Nayok Province.

Symptoms appeared in August shortly after flood inundation. In 38 fields examined from November 1981 to January 1982, more than 7% of the stems showed RSV symptoms. Infected plants labeled in the field in October and November at the end of the vegetative phase were totally unproductive at maturity 2 months later. Six severely infected farmers' fields (averaging 23% infected stems) had a mean yield of 1.4 t/ha, 16 slightly infected fields (averaging 5% infected stems) had a mean yield of 2.5 t/ha.

Disease incidence did not appear to be related to high populations of the ragged stunt vector, the brown planthopper *Nilaparvata lugens.*



Severe stunting of Pin Gaew 56 caused by natural infection of ragged stunt virus. October 1981, Ayutthaya, Thailand. Water depth was 92 cm.

Rice varietal ability to withstand prolonged darkness in screening for submergence tolerance

Tawee Kupkanchanakul and Lalida Laisakul, rice researchers, Huntra Rice Experiment Station; Chai Prechachat, chief, Deep Water Rice Branch; and Ben R. Jackson, plant breeder, The Rockefeller Foundation. and IRRI representative to Thailand

Because light penetration is low at water depths of 110 cm, the exceptional survival of FR13A in 110-cm water could be related to ability to withstand prolonged periods of low light intensity. Fifty-day-old seedlings of susceptible (KDML105), moderately tolerant (IR8234-OT-9-2), and tolerant (FR 13A) entries were subjected to total darkness, without submergence, for 10 days. Also, leaf yellowing was measured on 30-, 40-, and 50-day-old seedlings after 4, 6, and 10 days of darkness.

Response to total darkness for 10 days was similar to reaction to submergence in the standard screening test (Table 1). Tiller number was also reduced. Older plants were slower to exhibit leaf yellowing (Table 2). After 10 days of darkness, 50-day-old seedlings of moderately tolerant lR8234-OT-9-2 had 4 times as much leaf yellowing as highly tolerant FR13A.

If a strong association between leaf yellowing and survival under darkness exists, large-scale screening for submergence tolerance could be conducted without deep ponds and water pumping costs.

Table 1. Comparative response of rice genotypes[a] to submergence and darkness, Huntra Rice Experiment Station, Thailand 1982.

Genotype	Survival (%) after 7 days		Tillers (no./pot)		
	Dark treatment 10 days	Submerged 10 days	Dark treatment 10 days	Submerged 10 days	Control
KDML105 (susceptible)	0.0	10.0	0.0	3.0	33.0
IR8234-OT-9-2 (moderately tolerant)	50.0	35.0	21.0	15.0	43.0
FR13A (tolerant)	73.0	61.0	30.0	25.0	41.0

[a] 50-day-old seedlings.

Table 2. Leaf yellowing symptoms of susceptible, moderately tolerant, and tolerant rices in darkness, Huntra Rice Experiment Station, Thailand, 1982.

Variety or line	Plant age (days)	Leaf yellowing (%) of plants at indicated days of darkness		
		4d	6d	10 d
KDMLl05 (susceptible)	30	90.0	100.0	100.0
	40	15.0	95.0	100.0
	50	0.0	50.0	95.0
IR8234-OT-9-2 (moderately tolerant)	30	15.0	90.0	100.0
	40	5.0	60.0	90.0
	50	0.0	5.0[a]	20.0
FR13A (tolerant)	30	15.0	80.0	95.0
	40	5.0	50.0	80.0
	50	0.0	5.0[b]	5.0

[a] Leaf tip only. [b] Leaf margins only.

Pest management and control INSECTS

Control of rice thrips

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An experiment in 1980 kuruvai season evaluated insecticides for controlling *Baliothrips biformis* (Bagnall). An existing rice crop of variety TKM 9 which was infested severely at 50 days after transplanting was utilized. Chemicals applied at 625 liters/ha to 20-m^2 plots with a knapsack sprayer were: monocrotophos, phosphamidon, methyl demeton, chlorpyrifos, and BHC. Thrips on all leaves from 10 randomly selected hills were counted 72 hours after spraying.

All treatments, including water, reduced thrip density (see table). The insecticides, especially monocrotophos, gave good control.

Effect of insecticides on rice thrips at Tamil Nadu, India.[a]

Insecticide	Formulation	Dosage (kg a.i./ha)	Thrips density (no./10 hills)	Pest reduction (%)
Monocrotophos	40 EC	0.25	3 a	97
Phosphamidon	100 EC	0.63	5 ab	90
Methyl demeton	25 EC	0.16	6 bc	87
Chlorpyrifos	20 EC	0.13	8 cd	83
BHC	10 dust	2.47	9 e	81
Water only	–	–	26 f	45
Control	–	–	48 g	–

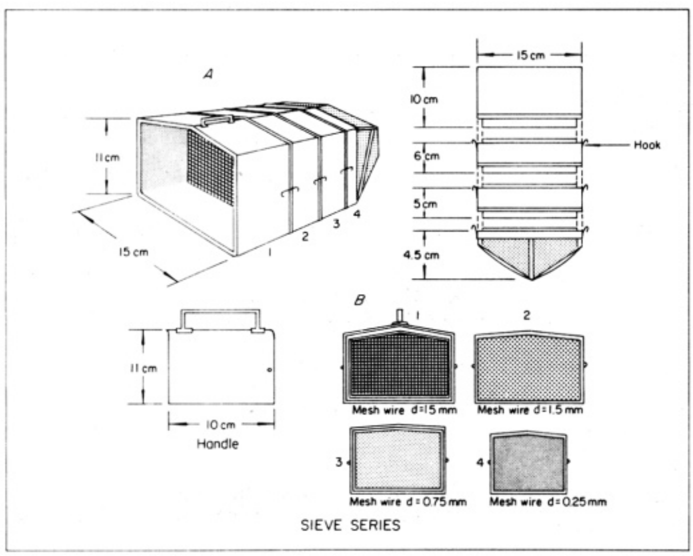
[a]Means followed by a common letter are not significantly different at 0.05% level.

A nested sieve sampler for collecting aquatic invertebrates in rice paddies

Alberto T. Barrion, research assistant, and James A. Litsinger, entomologist, Entomology Department, International Rice Research Institute

A study of rice field aquatic habitats initiated in 1981 is cataloging invertebrate species in order to construct a foodweb for rice agroecosystems. This foodweb will be a basis for understanding the role of natural pest enemies and how pesturbations such as pesticide use may influence populations of rice insect pests.

An aquatic net is the standard collecting device used to collect invertebrates from streams and ponds. But a net cannot be used in puddled fields with heavy clay soils, shallow water, and closely spaced rice plants because it will not pass quickly through the mud. A number of invertebrates — chironomid larvae, coleopterans, mites, collembolans, small hemipterans, copepods, and ostracods — can escape collection.



Nested sieve sampler, side view (A) with 4 detachable nested sieves with 15, 1.5, 0.75, and 0.25-mm mesh diameter (B), developed for collecting aquatic invertebrates in rice paddies at IRRI.

A 25.5- × 15- × 11-cm metal sampler with 4 nested sieves (see figure) has been used at IRRI for 1 year. It fits between rice hills and can be forced through the mud.

Effects of rice ragged stunt virus on its vector *Nilaparvata lugens*

L. G. Zhou, K. Y. Tu, L. Tsao, and S. Y. Li, Plant Protection Institute, Guangdong Academy of Agricultural Sciences (GAAS), Guangdong, China

Virus-free insects were fed on rice ragged stunt infected plants during the first 2 days after hatching, 6 days after hatching, and the entire nymphal period.

In the 2-day feeding, viruliferous female brown planthoppers lived 21.4 days and the males, 22.2 days; in the control, females lived 16 days and males, 24.8 days. In the 6-day feeding, viruliferous females lived 20 days and males, 18.1 days; in the control, females lived 21.4 days and males, 21.4 days. The effect of the virus on the life span of nymphs and adults is not significant. There was no difference in number of instars nor duration of instar feeding on diseased plants during the entire nymph period.

The viruliferous vectors laid 29.7% fewer eggs in the 6-day feeding and 44.5% fewer eggs in the nymphal feeding period than did the control insects.

The attraction of brown planthoppers and green leafhoppers to colored lights

V. Kr. Sathiyanandam and A. Subramanian, Paddy Experiment Station, Aduthurai, Tamil Nadu, India

To study the attraction of brown planthoppers and green leafhoppers to colored lights, observations were made using petromax lights covered with yellow, green, and red shades. The lights were distributed October to December 1979 on the bunds of paddy fields every night from 1800 to 2000 hours. Insect pests trapped in water with a few drops of kerosene in a tray around the lights were collected and identified (see table).

Both insect pests were more active during October than during November and December. Yellow attracted considerably more brown planthoppers and green leafhoppers than did green and red.

Attractiveness of colored lights to brown planthoppers and green leafhoppers at Aduthurai, India.

Light color	Trapped brown planthoppers (no.)				Trapped green leafhoppers (no.)			
	Oct	Nov	Dec	Total	Oct	Nov	Dec	Total
Yellow	6036	442	78	6556	5073	355	127	5555
Green	2937	188	40	3165	1634	178	72	1884
Red	2409	235	36	2680	1397	220	67	1684

Time of transplanting and gall midge incidence in Manipur

S. Amu Singh, district agricultural officer, Tengnoupal, Chandel, Imphal, Manipur, India

Time of transplanting and incidence of gall midge were studied during the 1979-80 insect outbreak in Imphal West. Three highly susceptible rice varieties received no pesticide application. Fifty hills per variety, replicated four times, were sampled. Percentage silver shoots was calculated as the ratio of number of silver shoots to number of tillers per 50 hills at maximum tillering.

The later the planting date, the higher the gall midge incidence (see table). The State Department of Agriculture currently recommends transplanting the test varieties in June and July. However, by June gall midge incidence is already high.

Time of transplanting and incidence of gall midge in 3 varieties in Imphal, India.[a]

Time of transplanting	Silver shoots (%)			
	Punshi	Phouoibi	IR24	Average
2d week June	10.81 (10.98)	6.83 (15.06)	8.12 (16.48)	8.59
3d week June	15.21 (22.37)	12.05 (19.93)	12.96 (21.07)	13.41
4th week June	24.63 (29.42)	17.96 (25.00)	17.36 (24.27)	19.98
1st week July	26.1 3 (30.71)	20.36 (25.85)	21.09 (26.73)	22.52
2d week July	28.03 (3 1.97)	22.52 (28.33)	27.02 (31.20)	25.86
3d week July	37.03 (37.29)	27.80 (31.83)	31.94 (34.05)	32.26
CD (P = 0.05)	9.65	7.73	8.89	

[a] Figures in parentheses are transformed angular values.

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, photographs. Contributions are subject to editing and abridgement to meet space limitations. Authors will be identified by name, title, and research organization.

Effect of custard-apple oil and neem oil on the life span of and rice tungro virus transmission by *Nephotettix virescens*

V. Mariappan, R. C. Saxena, and K. C. Ling, International Rice Research Institute

Most insect damage results from direct feeding or indirect transmission of pathogenic organisms during feeding. Antifeedant chemicals offer a novel approach to pest control. Seed oils of neem *Azadirachta indica* and custard-apple *Annona* sp. possess marked antifeedant properties. These plants are widespread in many rice-growing countries in South and Southeast Asia.

Oils were emulsified with 0.1% liquid detergent and tested at 5 concentrations (5, 10, 20, 30, and 50%). Crude neem seed oil was expelled from decorticated seeds obtained from India. Custard-apple seed oil was obtained by methanolic extraction of seeds obtained at IRRI. Ten-day-old TN1 rice seedlings were sprayed 3 hours before they were exposed to the viruliferous vector insect. Control plants were sprayed with a 0.1% detergent solution. Treated seedlings were placed in glass test tubes (15 × 1.5 cm) and covered with polyvinyl caps.

Viruliferous insects used were *N. virescens* adults reared on virus-free 45-day-old TN1 rice plants and allowed 4-day acquisition feedings on source plants. A viruliferous insect was released into each test tube for inoculation feeding. After 24 hours, the viruliferous insect was transferred to another freshly treated seedling and inoculated seedlings were transplanted in pots for disease development. Successive inoculation and access feeding on treated plants continued until the death of all the viruliferous insects. Symptoms in inoculated seedlings were observed on day 12.

The randomized complete-block design experiment was replicated 5 times using 440 viruliferous insects and 440 treated seedlings for 11 treatments. A total of 2,200 viruliferous insects and 4,667 treated seedlings were used.

Both oils reduced insect survival and RTV transmission. One day after feeding, 95.5% of the insects survived in the control. Survival was significantly less on all oil-sprayed plants — the higher the oil concentration, the lower the insect survival (Table 1) — but differences in insect survival at different oil concentrations were not significant.

Two days after feeding, insect survival on the control averaged 86.5%. In the custard-apple oil treatment at 30% concentration, only 1.5% of the insects survived; at 50% concentration, none survived. In neem oil treatments, 2.5% of the insects survived at both concentrations. Three days after feeding, insect survival was near zero in most treatments.

Transmission of RTV by the viruliferous insect to oil-sprayed TN1 rice seedlings was represented by the number of infected seedlings. One-day inoculation feeding infected 60.4% of the control seedlings. Infection of oil-sprayed seedlings was significantly less at all concentrations of both oils (Table 2).

After 2 days of inoculation feeding, 35.5% of the control seedlings were infected; significantly less infection occurred in all oil treatments. Both oils at 5% concentration significantly reduced RTV infection of TN1 seedlings, on par with infection levels at higher concentrations. After 3 days of feeding, only a few plants were infected. After 4 days of feeding, no seedlings were infected because no insects survived on oil-sprayed plants.

Table 1. Survival of *Nephotettix virescens* after 1, 2, and 3 days exposure to TN1 rice seedlings sprayed with oils[a] at IRRI.

Oil concentration (%)	Survival (%) of *N. virescens*[b]					
	1 d		2 d		3 d	
	C-ao	No	C-ao	No	C-ao	No
5	25.0 b	57.5 b	5.0 b	23.5 b	0	7.0 b
10	27.5 b	36.5 cd	5.5 bc	16.5 bc	0.5 b	5.5 b
20	22.5 bc	42.0 c	6.0 b	8.0 bc	1.0 b	0 b
30	16.5 bc	34.0 cd	1.5 b	2.5 c	0 b	0 b
50	1.5 c	26.6 d	0 b	2.5 c	0 b	0 b
0 (control: water + 0.1% liquid detergent)	95.5 a	95.5 a	86.5 a	86.5 a	80.0 a	80.0 a

[a]C-ao = custard-apple oil, No = neem oil. [b]In a column, means followed by a common letter are not significantly different at the 5% level.

Table 2. Rice tungro virus (RTV) infection on TN1 rice seedlings sprayed with oils[a] after 1 and 2 days exposure to viruliferous insects at IRRI.

Oil concentration (%)	RTV infection (%) of TN1 seedlings[b]			
	1 d		2 d	
	C-ao	No	C-ao	No
5	25.0 b	27.0 b	6.9 b	13.6 b
10	19.0 bc	16.4 bc	4.2 b	11.2 b
20	19.0 bc	20.9 bc	2.4 b	10.2 b
30	20.4 bc	13.6 c	11.0 b	4.5 b
50	10.5 c	11.8 c	0.2 b	10.3 b
0 (control: water + 0.1% liquid detergent)	60.4 a	60.4 a	35.5 a	35.5 a

[a]C-ao = custard-apple oil, No = neem oil. [b]In a column, means followed by a common letter are not significantly different at the 5% level.

Effect of foliar insecticides on stem borers and leaffolders

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The effect of six foliar insecticides on rice stem borers and leaffolders was studied at Tirur during the 1980-81 samba season. The field trial was laid out in a simple randomized block design with three replications. IR8 seedlings 35 days old were planted in 12-m² plots at 20 × 10-cm spacing. Insecticides were sprayed at 45 and 60 days after transplanting (DT).

Deadhearts (stem borer damage) in each plot and leaf damage (leaffolders) on 50 hills/plot were assessed at 75 DT (see table). Bendiocarb, acephate, and carbosulfan were more effective in checking both stem borer and leaffolder. Their use gave higher yields than did three other chemicals and no treatment.

Effect of new foliar insecticides on rice stem borers and Ieaffolders. Tirur, India. 1980-81 samba.

Treatment	Formulation	Quantity applied (kg a.i./ha)	Stem borer deadhearts 75 DT		Leaffolder damage 15 DT		Grain yield (t/ha)
			No.	Square root	%	Angles	
Carbosulfan	24 EC	0.4	18.8	4.34	7.1	15.47	5.5
Bendiocarb	80 WP	0.5	12.0	3.47	2.5	9.03	6.1
BPMC	20 EC	0.5	26.9	5.19	23.9	29.29	5.1
Acephate	75 SP	0.5	6.8	2.61	4.2	11.76	6.1
Vamidothion	30 EC	0.5	37.6	6.13	35.8	36.79	3.9
Ethion	50 EC	0.5	29.8	5.46	48.2	43.95	3.1
Control	–	–	35.5	5.96	68.9	56.11	1.8
CD	–	–	–	1.32	–	9.52	1.5

Pest management and control WEEDS

New weed host of rice stem nematode identified in Vietnam

Nguyen-thi Thu Cuc, Plant Protection Department, Cantho University, Hau Giang, Vietnam

Leersia hexandra has been recognized as a unique weed host of stem nematode *Ditylenchus angustus.* Fourteen other weeds grow in Mekong Delta rice fields: *Echinochloa colona, E. crus-galli, Sacciolepis interrupta, S. polymorpha, S. myosuroides, Panicum trichoides, Brachiaria mutica, Fimbristylis littoralis, Cyperus iria, C. difformis, Scirpus grossus, Eichhornia crassipes, Monochoria hastata,* and *Polygonum scabrum.*

When artificial inoculation methods were used, *D. angustus* attacked two additional weed species — *S. interrupta* and *E. colona.* Degree of infestation and the time needed for symptoms to appear differed.

Two months after inoculation, 80% of the tillers of *S. interrupta* were infested, with an average 12.5 nematodes/tiller. *E. colona* had 30% diseased tillers with 0.5 nematode/tiller. Control rice variety IR20 had 90% diseased tillers and 17.5 nematodes/tiller. Symptoms appeared 7-8 days after inoculation on *S. interrupta* and IR20, but 10-15 days after on *E. colona.*

S. interrupta could be a secondary host of *D. angustus,* acting as a bond between rice crops.

Effect of herbicide weed control on soil microflora in direct-sown, fertilized, wetland rice

G. K. Patro, Orissa University of Agriculture and Technology, Bhubaneswar, Orissa, India

Nine weed control treatments and three fertilizer levels were used on drill-sown IET723 in a split-plot design with 3 replications.

One postemergence spray of propanil at 2 kg ai/ha 15 days after sowing effectively controlled weeds (see table) and was even more effective with supplemental weeding 40 days after sowing. Propanil and butachlor were similar in weed control efficiency in 1973 and 1975, but propanil was significantly better in 1974. Weed growth increased with increased fertilization.

Bacterial populations were higher than fungal populations in all treatments. There was an initial rise of fungal populations in 2,4–D-treated plots and a drop in butachlor-treated plots. Fungal and bacterial populations were stable in propanil-treated plots. Mid-level fertilizer treatments showed slightly higher populations of fungi and bacteria than did the low fertilizer levels.

Effect of weed control treatment and fertilizer level on weed growth and soil microflora in rice, Orissa, India.

Treatment	Dry weight of weeds at harvest (g/50-cm × 50-cm area)			Average fungi population (10^4/g soil, oven-dry basis) 70 DS	Average bacteria population (10^6/g soil, oven-dry basis) 70 DS
	1973	1974	1975		
Main plot					
Na salt of 2,4-D @ 1.5 kg a.i./ha	70.0	42.3	97.4	6.0	6.4
Butachlor @ 2.0 kg a.i./ha	51.8	39.3	75.7	4.1	8.6
Na salt of 2,4-D @ 1.5 kg a.i./ha + weeding by weeder at 40 DS	53.9	25.4	77.5	5.7	6.6
Butachlor @ 2.0 kg a.i./ha + weeding by weeder at 40 DS	38.9	24.1	54.0	4.1	8.5
Propanil @ 2.0 kg a.i./ha	49.5	32.5	72.7	5.0	7.7
Propanil @ 2.0 kg a.i./ha + weeding by weeder at 40 DS	29.1	20.1	46.6	5.3	7.7
Propanil @ 2.0 kg a.i./ha + MCPA @ 1.0 kg a.i./ha	44.4	25.6	59.9	5.2	7.7
Conventional farmers' practice[a]	37.0	27.8	62.4	5.2	7.5
Unweeded control	176.3	147.2	272.7	5.1	7.7
CD (0.05)	7.38	6.59	6.59	1.45	1.71
Subplot					
60-30-30 kg NPK/ha	55.6	39.3	83.8	5.2	7.5
90-45-45 kg NPK/ha	60.4	43.4	91.5	5.6	7.8
120-60-60 kg NPK/ha	67.6	45.6	97.6	5.5	7.7
CD (0.05)	2.64	2.03	2.25	0.47	0.54
(Microbial population of basic soil before cropping)				5.2	7.7

[a]Blind tillage at 30 DS (days after sowing) with a spike-tooth harrow, followed by 2 hand weedings at 35 and 50 DS.

Pest management and control OTHER PESTS

Molluscan pests of azolla

P. B. Chatterjee, entotmologist, All India Coordinated Rice Improvement Project, Chinsurah Research Station 712 102, India

Destruction of azolla by snails poses a serious problem to mass multiplication in India. Snails primarily responsible for azolla loss are:

Lymnaea (Pseudosuccinea) luteola f. *typica* Lamarck. A small and floating snail, common in wet rice fields almost year round. Peak season is July-October. It swims in water and, with the help of its foot, adheres to the rice stem, often above water level. In azolla-multiplying tanks, it clings firmly and feeds voraciously.

Bellamya bengalensis f. *typica* (Lamarck). A cone-shaped snail found in rice fields and water courses year round. Peak population is in July-September when there are heavy monsoon showers. It often is submerged in wet rice fields and in azolla multiplying tanks.

Pila globosa (Swainson). A big, almost globular snail seen in wet rice fields and water courses almost year round, except in December and January when cold weather sets in and most rice fields become dry. Peak numbers in rice fields and azolla multiplying tanks are found July-September.

Laboratory experiments determined the rate of feeding on azolla by the three snail species (see table). Room temperature was 21°-26° C.

Rate of feeding on azolla by 3 species of snail in Chinsurah, India.

Snail	Av wt (g) of adult snail (mean of 20 specimens)	Rate of feeding/24 hours per snail (g)
Lymnaea luteola	0.20	0.1 9
Bellamya bengalensis	2.90	0.33
Pila globosa	34.01	0.98

Bird damage on some rice varieties at Aduthurai, India

S. Uthamasamy, K. M. Balasubramaniam, and N. M. Ramaswamy, Tamil Nadu Rice Research Institute, Aduthurai, India

Rose-ringed parakeets *Psittacula krameri,* house sparrows *Passer domesticus,* and weaver birds *Ploceus* spp. feed on rice grains from milky stage on. Damage caused by birds was observed during 1981 kharif. Experimental plots were 1 m² with 4 rows of 10 hills each for 16 varieties. Total panicles and damaged panicles were counted on 10 randomly selected hills of each variety and a Standard Evaluation System for Rice damage rating was assigned. The angle of the boot leaf to the panicle was measured.

Twelve varieties had more than 20% damage (see table). IR30 was completely destroyed, Pankaj had no damage. IR20, the most popular variety in the region, had 32.1% damage.

Where the angle between boot leaf and the panicle was narrow, bird damage was less than in varieties having wider angles. The damage was also less in varieties having a boot leaf as long as or slightly longer than the panicle.

Bud-damaged panicles on some rice varieties at Aduthurai, India.

Variety	Damaged panicles (%)	Damage rathing [a]	Angle of boot leaf to panicle
Pankaj	0.0	0	10-15
IR8	8.7	5	40-60
IR32	10.0	5	10-30
IR48	13.1	5	30-40
IR24	21.9	5	40-60
IR54	26.9	9	40-60
IR20	32.1	9	40-90
IR5	34.2	9	40-90
IR36	41.6	9	40-60
IR52	52.9	9	20-60
IR26	61.0	9	30-50
IR5 0	63.2	9	40-80
IR40	72.3	9	30-80
IR22	76.2	9	40-90
TNAU20216	90.0	9	80-160
IR30	100.0	9	60-90

[a] 1980 *Standard Evaluation System for Rice* scale: 0 = no damage, 9 = 26-100%.

ERRATA

Roy, A. K. Effect of sheath blight infection on respiration and transpiration of rice plants. Vol. 7, No. 1 (Feb 1982):

On page 20, line 7 of the middle column should read "increased (difference in manometric"

Soil and crop management

Effect of surface application of straw on phototrophic nitrogen fixation

P. A. Roger, visiting scientist (ORSTOM, France); A. Tirol, research assistant; I. Grant, postdoctoral fellow; I. Watanabe, head, Soil Microbiology Department, International Rice Research Institute

A field experiment during the dry season tested the effect of surface application of straw on phototrophic nitrogen fixation. Continuously flooded study plots had received no N fertilizers for 5 years. Subplots were 1-m × 1-m metal frames inside each experimental plot. IR36 was transplanted at 16 hills/subplot at 20-cm × 20-cm spacing. Weeds were removed as they emerged. Treatments (each with 3 replications) were:

Control: carbofuran added at 3 kg active ingredient/ ha every 2 weeks.

Straw treatment: ground straw (0.85% N) applied at 300 g/m^2 (3 t/ha). Carbofuran applied as in control.

Nitrogen-fixing activity (acetylene

reduction) was measured and N_2-fixing blue-green algae (BGA) were counted 6, 41, 61, 84 and 98 days after transplanting (DT).

Seven core soil samples were taken randomly from each 1-m^2 plot by inserting 2-cm diameter, 12-cm-long glass tubes to about 5 cm below the soil surface. Tubes were plugged at the bottom and placed inside an airtight transparent cylinder, 7.2 cm in diameter and 32 cm long.

Incubation was in an atmosphere of 10%, acetylene in air under sunlight (45-50 klux). A water bath maintained cylinder temperatures at 30-35°C. Ethylene produced after 15 minutes, 1 hour, and 3 hours incubation was determined by gas chromatography. The atmosphere of the cylinders was mixed before each sampling with a 50-ml syringe.

The same core samples were used to enumerate N_2-fixing BGA. Suspension dilutions of soil were plated on BG 11 medium without nitrogen.

Blooms of BGA appeared, but were not present in all replications of a given treatment at a given time. This agrees with results of acetylene reduction activity measurement, which varied widely between replications (see table). The small size of the plots, the irregular distribution of BGA in the fields, and the protection from inoculation by the water or the soil of the surrounding field by a continuous frame may not have permitted simultaneous growth of N_2-fixing BGA in the different replications of a treatment.

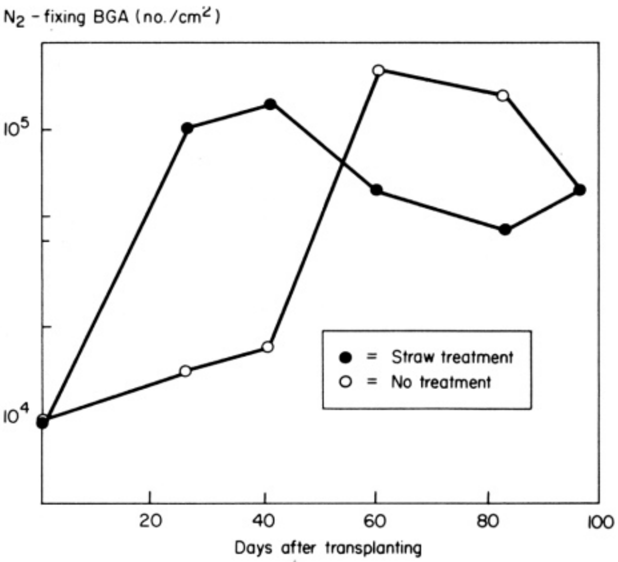
Plots in which straw was applied were characterized by an earlier growth of N_2-fixing BGA and a significantly higher ARA at the beginning of the growth cycle of rice (see figure). The presence of photosynthetic bacteria was not measured.

The beneficial effect of surface application of straw on photosynthetic N_2-fixation may be due to an increase of CO_2 availability in the photic zone, a decrease of mineral N and O_2 concentrations in the floodwater, and the provision of micro-aerobic microsites by the straw. Increased CO_2 availability and a low N concentration are known to favor the growth of N_2-fixing BGA. A low O_2 concentration and the micro-aerobic sites in the photic zone may have increased their specific nitrogen-fixing activity.

Acetylene reduction activity (ARA) present in paddy soil sampled at given days after transplanting (DT) of a rice crop at IRRI. [a]

	ARA[b] (mmol C_2II_4/m^2 per hour)					
	26 DT	41 DT[c]	61 DT	84 DT	98 DT[d]	Av
Control	32 a (80, 8, 8)	0 a (0, 0, 0)	115 a (60, 157, 128)	27 a (1, 80, 3)	113 a (4, 320, 13)	57
Straw applied	795 b (1224, 795, 366)	0 a (0, 0, 0)	65 a (20, 113, 8)	2a (6, 0, 0)	41 a (18, 3, 103)	180

[a] Three hours incubation. [b] Figures in parentheses are replication values. Av values followed by common letter are not significantly different. [c] Measured 1 day after a heavy rain (80 mm). [d] Measured after harvest.



Evolution of the population of N_2-fixing BGA during a rice crop at IRRI.

Carryover effects of blue-green algae multiplication on subsequent direct-seeded paddy crop

S. Srinivasan, R. Anandan, and P. Narashimhan, Paddy Experiment Station, Aduthurai 612101, Tamil Nadu, India

Blue-green algae (BGA) seed production was undertaken at the state seed farm Kancheepuram during 1981 with four algal harvests from 25 April to 12 June. A demonstration followed to show farmers a crop grown without additional nitrogen on a plot where BGA had been grown for seed.

Rice variety TKM9 was sown in 20 cm lines in the BGA 0.6-ha multiplication plot on 15 June. K_2O was applied at 60 kg P_2O_5/ha for algal seed multiplication, no phosphate fertilizer was applied. TKM9 was direct-seeded in a similar area with the normal application of 100-60-60 kg NPK/ha. Line spacing was maintained at 10 cm by thinning and gap filling 20 days after sowing. Both plots were harvested 20 September.

Results showed that even under direct seeding, a yield benefit equivalent to 100 kg N/ha can be obtained in a crop grown in a plot where BGA was grown for more than 45 days (see table). This may be due to exudation of nitrogenous and other growth-promoting and growth-regulating substances during algal multiplication.

Effect on rice yield of blue-green algae multiplication before the crop in Tamil Nadu, India.

Treatment	Yield (t/ha)
Blue-green algae multiplication site (no N)	5.3
Standard (100 kg N/ha)	5.1

Effect of moisture regime on rice yields in Alfisols and Vertisols

J. H. Dongale and A. S. Chavan, Department of Agricultural Chemistry and Soil Science, Konkan Krishi Vidyapeeth, Dapoli 415 712, Maharashtra, India

A greenhouse experiment studied the effect of different moisture regimes on growth and yield of rice Jaya in lateritic (Alfisol) and medium black (Vertisol) soils, two important types in the warm and humid agroclimatic region of Maharashtra State, India.

Three moisture regimes were maintained: half the maximum water-holding capacity, soil saturation, and soil submergence.

All treatments received 100 kg N and 50 kg P_2O_5/ha.

The optimum moisture regime was soil saturation in Alfisol, and soil submergence in Vertisol (see table). In Alfisol, the crop matured in 131 days in all moisture regimes. In Vertisol, days to maturity decreased as moisture increased.

Effect of moisture regimes on yield and yield-contributing characters of rice variety Jaya on 2 soils in Maharashtra, India.[a]

Moisture regime[b]	Plant ht (cm)	Panicle no.	1000-grain wt (g)	Yield (g/pot)		Grain-to-straw ratio	Days to maturity	Harvest index (%)
				Grain	Straw			
				Alfisol				
M1	77	4	24.9	6.15	6.75	0.91	131	44.89
M2	82	4	28.0	7.51	6.65	1.12	131	50.44
			(12.23)	(22.11)	(–1.48)			
M3	84	4	27.0	6.11	7.45	0.82	131	41.59
			(8.26)	(–0.65)	(10.37)			
				Vertisol				
M1	87	9.5	20.2	7.82	20.50	0.38	142	24.52
M2	90	11.5	20.5	11.90	23.50	0.50	138	30.65
			(1.53)	(52.17)	(15.76)			
M3	105	13.5	22.2	18.53	27.40	0.67	131	36.15
			(10.06)	(136.95)	(34.97)			

[a]Mean of 2 replications. Figures in parentheses = % increase over M1. [b]M1 = half maximum water-holding capacity, M2 = soil saturation, and M3 = soil submergence.

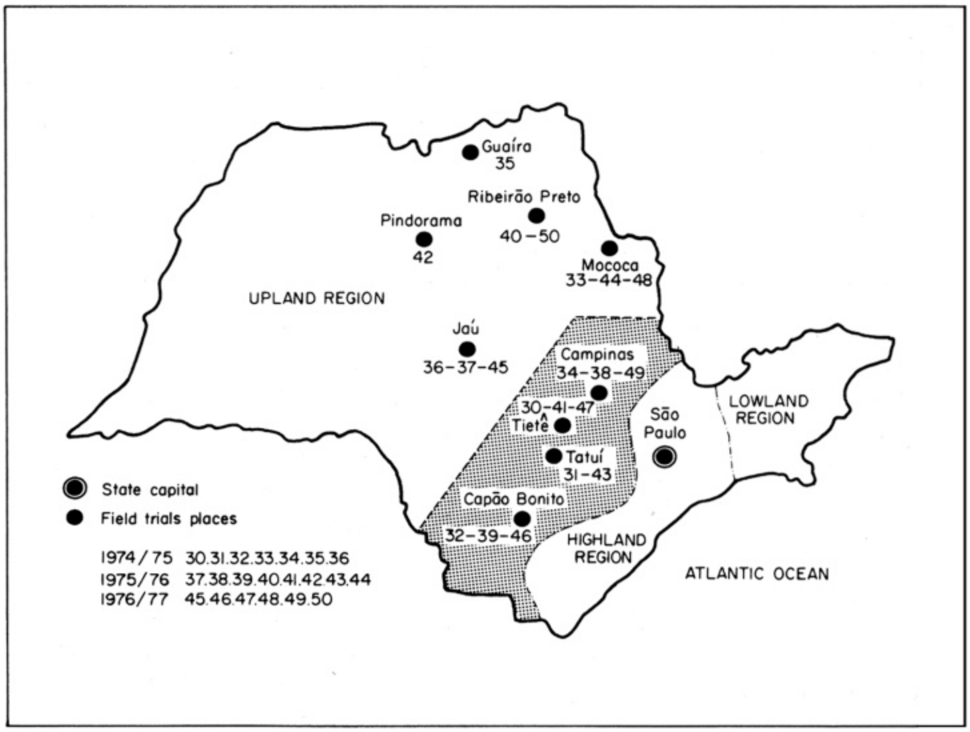
Environment and its influence

Effects of environment on yields of 8 dryland rice cultivars in São Paulo, Brazil

E. P. Silveira and R. Vencovsky, post-graduate student and professor of genetics, Escola Superior de Agricultura "Luiz de Queiroz" Universidade de São Paulo 13400, Piracicaba, SP, Brazil

Study of genotype (G) × environment (E) interactions can lead to an evaluation of the yield stability of different genotypes, providing information for use in breeding programs. Eight rice cultivars were studied in 3 seasons (1974-77) in 21 environments of São Paulo State. The research design was an 8 × 8 Latin square.

The expected mean square component for G × E interactions was estimated by a pooled analysis of variance for yield and environment, taken 2 by 2, 3 by 3, . . ., E by E, in each season. Locations with similar performances in all seasons were pooled into two groups:



Homogenous subregions suggested for dryland rice in São Paulo State, Brazil.

Yield performance of some promising dryland rice cultivars in São Paulo, Brazil.[a]

Cultivar	Mean yield (t/ha), 11 environ-ments	b	$\sqrt{s_d^2}$	r	Mean yield (t/ha), 10 environ-ments	b	$\sqrt{s_d^2}$	r	Mean yield (t/ha), 21 environ-ments	b	$\sqrt{s_d^2}$	r
IAC25	2.2 a	1	0.4		2.3 a	0.9	1.2**		2.3 a	0.9	0.8**	
IAC41	1.9 b	1	0.3		2.3 a	1.0	0.8**		2.1 a	1	0.6*	
P. Precoce	2.0 b	0.9	0.4		2.2 a	0.9	1.2**		2.1 a	1.1	0.8**	
				0.1				–0.01				0.08
Batatais	1.9 bc	0.8	0.2		2.3 a	1.1	1.2**		2.1 a	1.0	0.8**	
IAC5032	1.9 cd	0.0	0.2		2.0 a	1.0	0.7*		1.9 a	1.0	0.5	
IAC1246	1.8 cd	1.1	0.2		2.0 a	1.0	0.6*		1.9 a	1.0	0.5	
IAC1131	1.8 cd	1.1	0.3		2.0 a	1.0	0.8**		1.9 a	1.1	0.5	
IAC5544	1.8 d	1.1	0.3		2.0 a	1.0	0.7**		1.9 a	1.1	0.5	
$\bar{x}$	1.9	1.0	0.3		2.1	1.0	0.9		2.0	1.0	0.6	

[a]*5% and **1% levels of significance. Any two means followed by the same letter are not significantly different.
[b]and $\sqrt{s_d^2}$ = parameters of stability. $\bar{r}$ = mean correlation coefficient.

Gr_1 — Campinas, Tiete, Tatui, and Capao Bonito counties — and Gr_2 — Mococa, Pindorama, Kibeirao Preto, Guaira, and Jau counties (see figure). Linear and nonlinear components of G × E interactions and the mean correlation coefficient for grain yield were calculated for each group.

Pooled analysis of variance showed that the G × E, G × Gn_1, and G × Gr_2 interactions were highly significant. Despite having the lowest mean yield, Gr_1 showed an interaction variance component 5 times lower than G × E interactions. The high value of the mean correlation coefficient for this group characterizes it as a homogenous subregion.

On the basis of environment mean values, Gr_1 showed cultivar differences as well as the lowest mean yield. The highest overall mean yield was for IAC25 in Gr_2 and the lowest was for IAC5544 in Gr_1. The data on yield, mean correlation coefficient, and two parameters of stability are given in the table.

Good adaptability of cultivars, except for Batatais in the homogenous subregion, was indicated by the linear regression coefficients. IAC25, IAC47, Pratao Precoce, and Batatais yields were stable. But IAC 25 productivity and Batatais adaptation to unfavorable environments capability must be excluded from the homogenous condition. The inconsistent performance of all cultivars in the heterogenous subregion also should be excluded.

Yield and yield-contributing characters of photoperiod-sensitive rice varieties and their ratoons

S. K. Bardhan Rov, R. Ghosh, and J. Mondal, Rice Research Station, Chinsurah 712102, West Bengal, India

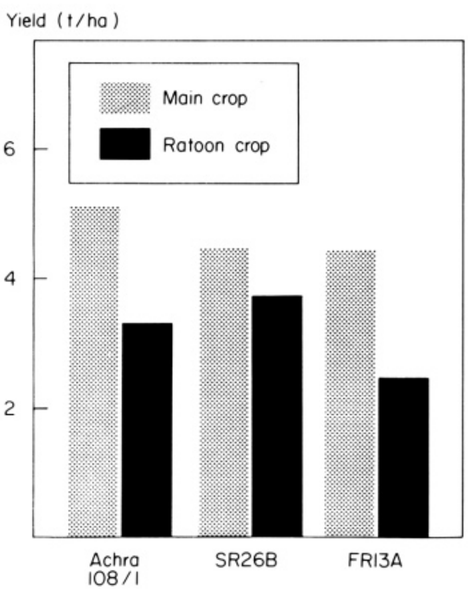
The yielding ability of ratoon and main crop of three photoperiod-sensitive rice varieties — FR 13A, SR26B, and Achra l08/1 — grown in the dry (boro) season were compared. The ratoons were higher than the main crop in all varieties (see table). Differences in effective tiller number and panicle length were small. Grain yields were less in ratoons than in main crops (see figure).

No relationship was found in yielding ability of the main crop and its ratoon. However, Achra 108/1 and SR26B had higher total yields.

Yield difference in SR26B between the main crop and the ratoon crop could be accounted for by lower grain numbers per panicle, lower 1,000 grain weight, and higher sterility.

Plant height, tiller number, and panicle length in main and ratoon crops of 3 photoperiod-sensitive rice varieties in West Bengal, India-

Variety	Plant height (cm)		Tiller no.		Panicle length (cm)	
	Main crop	Ratoon	Main crop	Ratoon	Main crop	Ratoon
FR13A	120	154	9	9	28	25
SR26B	136	172	9	7	26	27
Achra 108/1	129	185	8	8	26	28



Grain yield of 3 photoperiod-sensitive rice varieties and their ratoons

Announcement

Crop production course

The Agricultural University of Wageningen will offer an international postgraduate course, "Simulation and systems management in crop production," 9-18 November 1983.

The objective is to demonstrate a systems analysis approach to solving crop protection problems, and to help participants acquire elementary skill in systems analysis as a problem-solving tool. The course is for university graduates engaged in field crop protection.

For application forms and further information, write: Office of Post-Graduate Courses, POB 9101, 6700 HB Wageningen, The Netherlands, immediately.

Harnessing the monsoons: improved cropping systems in Asia

A thousand years ago, the dry zone of Sri Lanka was an irrigated rice bowl of Asia because the Sinhalese had dammed and diverted many rivers and constructed thousands of small, rainfed reservoirs or tanks. But many of these works fell into ruins, so that by colonial times, the dry zone rice farmer was forgotten.

Today, life is returning to the dry zone. Dams are being rebuilt and reservoirs repaired. In a pilot project at the tank-based village of Walagambahuwa, Sri Lankan agriculture researchers are showing small-scale rice farmers methods for double- and even triple-cropping. The key to success lies in the use of new rice varieties and a revised planting schedule that makes the most of the monsoon rains.

How the researchers and farmers put it all together is documented in a 27-minute,.16-mm film that records the partnership between modern science and ancient agricultural know-how, presenting a model of rural development that is being replicated in many other villages in Sri Lanka's dry zone.

The film is available on loan or purchase from the regional liaison officer, communications division, International Development Research Centre, Tanglin P. O. Box 101, Singapore 9124.

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