Gypsum (50% of the gypsum require-meat of the soil) plus 11.2 kg Zn/ha produced maximum grain yield. FYM alone or in combination with Zn was inferior even to 25% gypsum alone. ☐

Table 1. Effect of soil alkalinity on grain yield and straw-to-grain ratio of paddy, Kanpur, India.

Variety	Grain yield (t/ha)				Straw:grain			
	pH 8.7	pH 9.2	pH 9.6	Average	pH 8.7	pH 9.2	pH 9.6	Average
IR54	2.5	1.8	0.5	1.6	1.8	2.4	6.4	3.5
IR4563-52-1-1-3-6	4.2	3.7	2.5	3.5	1.2	1.1	1.6	1.3
IR9975-5-1	4.2	2.4	1.7	2.8	1.3	1.7	2.8	1.9
IR14632-22-3	2.6	2.0	2.1	2.3	3.3	3.7	3.8	3.6
IR19661-131-1-2	3.1	2.8	2.2	2.7	2.0	1.9	1.7	1.8
M242	2.4	2.3	2.5	2.4	2.2	1.7	1.9	1.9
Pokkali	4.7	3.6	2.9	3.7	1.8	1.9	1.7	1.8
Average	3.4	2.7	2.1		1.9	2.1	2.8	

Table 2. Effect of soil alkalinity on total P uptake and percentage translocation in grain, Kanpur, India.

Variety	Total P uptake (kg/ha)				% translocation of P in grain			
	pH 8.7	pH 9.2	pH 9.6	Average	pH 8.7	pH 9.2	pH 9.6	Average
IR54	13.2	12.9	8.1	11.4	62.9	40.2	21.8	41.6
IR4563-52-1-1-36	22.1	17.9	11.7	17.2	72.3	72.5	58.0	67.6
IR9975-5-1	24.2	14.3	13.3	17.3	67.0	57.1	44.8	56.3
IR14632-22-3	20.1	21.4	18.6	20.3	41.4	32.6	36.9	33.5
IR19661-131-1-2	19.6	16.6	11.7	15.9	56.2	56.3	60.3	51.6
M242	14.4	12.5	13.1	13.3	56.3	55.2	55.3	55.6
Pokkali	26.2	19.0	14.3	19.8	65.3	63.7	65.4	64.8
Average	19.9	16.3	12.9		60.2	53.9	48.6	

Varietal differences in P uptake of rice on sodic soils

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We screened salt-tolerant varieties IR54, IR4563-52-1-1-3-6, IR9975-5-1, IR146-32-22-3, IR19661-131-1-2, M242, and Pokkali for P uptake in sodic soils. Cultivars were transplanted in 4 replications in field plots with pH 8.5-8.9, 9.0-9.4, and 9.5-10.0. N, P, and K were applied at 120, 26, and 25 kg/ha as urea, single superphosphate, and muriate of potash. After harvest, grain and straw samples were analyzed for P content (Tables 1 and 2). Pokkali yielded best, followed by IR4563-52-1-1-3-6. IR54 yielded least. As pH increased, grain yield and P uptake decreased. Highest yielding varieties had comparatively higher translocation of P in grains (Table 2). ☐

Pest management and control DISEASES

A possible source of resistance to rice grassy stunt virus (GSV)

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The occurrence of a new GSV strain (GSV 2) that can overcome the resistance gene to ordinary GSV 1 prompted us to search for new sources of resistance.

A perennial rice plant, Guang-Keng A */Oryza rufipogon/Oryza longistaminata* (IRRI acc. no. 104315), was introduced from China in 1980. Plants were propagated by dividing tillers, and seedlings obtained in a natural set of these plants were tested for GSV 1 and GSV 2 infection (see table). Twenty to 130 viruliferous brown planthoppers (BPH) were allowed inoculation access for 2 to 4 d on the tillers and seedlings. Virus recovery tests were conducted on inoculated plants using virus-free BPH and the latex test confirmed the presence or absence of the virus.

Reaction of divided tillers and seedlings of Guang-Keng A/*Oryza rufipogon/Oryza longistaminata* (acc. no. 104315) to GSV 1 and GSV 2, IRRI, 1984.[a]

Plant part tested	Plant type	Inoculated strain	Insects[b] (no./plants)	Plants (no.) Inoculated	Plants (no.) Infected	Virus recovery[c] Plants (no.) Tested[d]	Virus recovery[c] Plants (no.) Recovered	Virus recovery[c] BPH (no.) Tested	Virus recovery[c] BPH (no.) Infective
Tiller		GSV 1	20	18	0	–	–	–	–
		GSV 1	50	4	0	–	–	–	–
		GSV 1	130	4	1	1	0	20	0
		GSV 2	50	21	1	1	0	40	0
Seedling	Dwarf	GSV 1	20	1	1	1	1	16	1
		GSV 1	120	2	2	2	1	80	1
	Tall	GSV 1	20	3	1	1	0	17	0
		GSV 1	120	1	0	–	–	–	–
	Dwarf	GSV 2	25	9	9	–	–	–	–
		GSV 2	120	1	1	1	1	40	1
	Tall	GSV 2	20	4	3	2	1	123	1
		GSV 2	25	5	1	–	–	–	–
		GSV 2	120	2	0	–	–	–	–

[a]Inoculation was done 2 or 4 wk after sowing. [b]2 to 4 d inoculation access period. [c]Done at various times (15–210 d) after inoculation. [d]Only infected plants were tested.

None of the 22 tillers inoculated with GSV 1 at 20 or 50 insects/tiller was infected. However, 1 of 4 was infected when the number of insects/tiller was increased to 130. One of 21 tillers inoculated with GSV 2 at 50 insects/plant was infected. This result showed that the perennial rice plant was highly resistant to both GSV strains and became infected only at high insect pressure.

Seedlings segregated into dwarf and tall plant types. All dwarf plants inoculated with GSV 1 or GSV 2 developed symptoms. One of 4 tall plants was infected with GSV 1 and 4 of 11 were infected with GSV 2. Because it requires only 10-15 insects/seedling in infection of susceptible varieties, results indicate that the tall plants had considerable resistance to both GSV strains.

Recovery of the virus from the tillers infected with either GSV 1 or GSV 2 was unsuccessful, even with 60 BPH. Recovery of the virus from either dwarf or tall type seedlings infected with GSV 1 or GSV 2 was also extremely difficult. Both GSV 1 and GSV 2 were recovered from infected plants but percentage of BPH which acquired the virus was only 1.8% and 1.2%.

The presence of virus in all infected plants used as a virus source was confirmed by latex test. BPH survived and reproduced well on the tillers and seedlings. Hence it is not likely that the resistance of the tall plant type and the difficulty of virus recovery by the BPH are caused by plant resistance to BPH. □

Brown stripe (BSt), a new bacterial disease of rice

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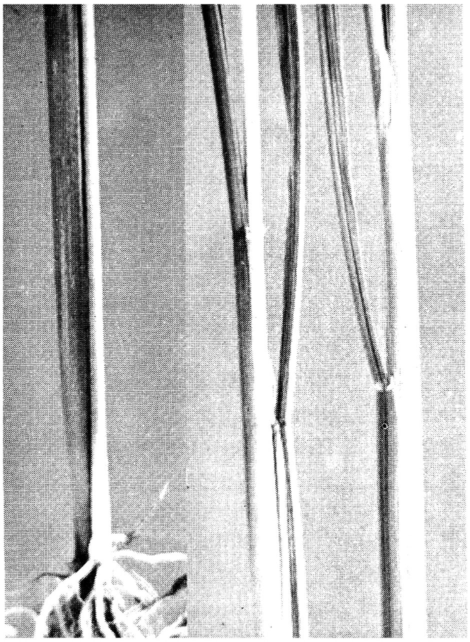
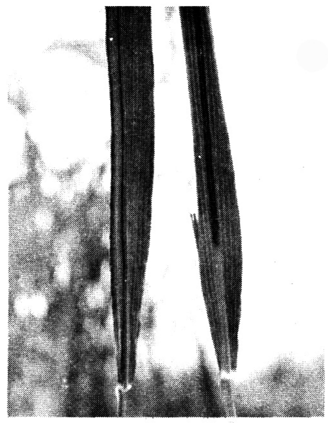
BSt is a new bacterial disease of rice in Brazil. Symptoms are pronounced, necrotic brown stripes along the midrib and lateral leaf veins. Early symptoms are 1- to 3-mm-wide light yellow water-soaked stripes along the midrib of the leaf blade, progressing from the base to the tip of the leaf. Similar brown stripes are found on the lateral veins and margins of leaf blades. In many cases, the stripes extend from the basal node to the leaf sheaths and leaves (Fig. 1). Usually, only one or two tillers in a plant are affected. As the disease progresses, leaves with stripes and the entire tiller wither. In severe infestation, the affected plants may die or become severely stunted. In the field, the disease symptoms appear from about 60 d after seeding to heading.

Microscopic examination of leaf bits with brown stripes showed streaming of bacteria through the vascular tissues of the cut end. However, there was no bacterial exudate on the leaf surface. Isolates from diseased leaf and sheath resulted in pure culture of the bacterium. On potato dextrose agar, colonies are creamy white and umbonate, and have undulate margins. The bacterium is facultatively anaerobic, gram-negative, rod-shaped, and peritrichous (Fig. 2). Its morphological and cultural characteristics suggest that it belongs to *Erwinia.* Preliminary biochemical tests indicate that it belongs to the 'amylovora' group.



1. Field symptoms showing brown stripes extending from the basal node to sheath (left) and leaf (right).

2. Bacterial cells showing flagella.



3. Brown stripes in the naturally infected (left) and artificially inoculated leaves (right).

Inoculations of a 24-h-old *Erwinia* culture by injecting a 10^9 – 10^{10} cfu/ml bacterial suspension into midribs of the healthy leaves in adult plants grown in pots produced symptoms typical of BSt (Fig. 3). The pathogen was readily isolated from artificially inoculated plants. Similar inoculations with water, *Xanthomonas campestris* pv *phaseoli,* and *Pseudomonas syringae* pv. *tabaci* did not produce BSt.

In 1971, a disease with similar symptoms was registered in the State of São Paulo, Brazil. However, its cause was not established. BSt occurs in all rice-growing uplands in Brazil, and the disease was recently observed in irrigated rice fields at Goiania. Preliminary evidence indicates that it is transmitted through seed. Further studies to identify species, and cultural and physiological characters of the pathogen are under way. □