phos and diazinon are unknown. Past experience with diazinon for BPH control also yielded different greenhouse and field trial results. Diazinon has always given poor BPH control in the field. Whether or not monocrotophos is an effective BPH control in the field needs further assessment.

Orthoptera pests of transplanted rice in hills of Uttar Pradesh

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Grasshoppers, crickets, and a mole cricket have been found to cause heavy damage to transplanted rice in the hills of Uttar Pradesh. Damage is most severe in the nursery. Sometimes, the leaves of seedlings are completely eaten, leaving only the midrib and stalks. Before infesting a rice crop, nymphs and adults generally feed on grasses growing on rice field bunds or on sorghum and millet.

Ten orthopteran pests have been identified from 4 years' observations and the intensity of damage determined (see table).

Identification of species was confirmed by the Commonwealth Institute of Entomology, London.

Orthopteran species causing rice seedling damage in the Uttar Pradesh hills, India.

Family	Species	Intensity
Acrididae	*Acrida exaltata* (Walk.)	Moderate
	Catantops pinguis innotabilis	Low
	Hieroglyphus banian (F.)	High
	Oxya fuscovittata (Marschall)	High
Pyrgomorphidae	*Atractomorpha crenulata* (F.)	High
	Chrotogonus sp.	Moderate
Gryllidae	*Trigonidium cicindeloides* (Serville)	Moderate
	Teleogryllus occipitalis (Serville)	Low
Tettigoniidae	*Euconocephalus* sp.	Moderate
Gryllotalpidae	*Gryllotalpa* sp.	Low

Soil and crop management

Upland rice varietal reactions to aluminum toxicity on an Oxisol in Central Brazil

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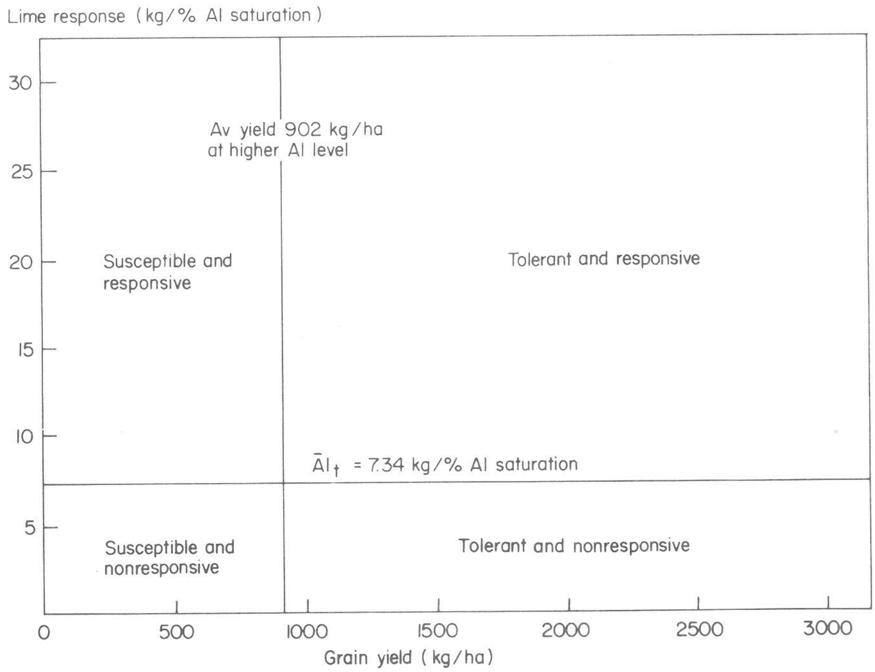
Brazil is the world's largest upland rice producer. About 70% of this production comes from the central region (22% of the country's area) which is a tropical savanna locally called *cerrado*. Aluminum toxicity causes serious yield reductions in this region. A CNPAF research program was initiated to identify rice cultivars tolerant of aluminum toxicity in the field.

Soil at the experimental site had pH 5.2, 0.52 ppm available phosphorus, 0.25 meq exchangeable Ca + Mg/100 g soil, 15 ppm available potassium, and 0.55 meq exchangeable aluminum/100 g soil.

Either no lime was applied to plots, or lime was applied at 3 t/ha. All plots were fertilized with 50 kg N/ha, 44 kg P/ha, 50 kg K/ha, and 5 kg Zn/ha. They were plowed and disked 50 days before sowing and lime was broadcast and mixed with a rototiller. Fertilizers were broadcast before sowing and disked into the top 15 to 20 cm soil. Seeds of 142 varieties were planted in



Varietal evaluation at high and low levels of aluminum, Goiás, Brazil.

$$\text{Lime response} = \frac{\text{yield in limed plot} - \text{yield in unlimed plot}}{\text{Al saturation of limed soil} - \text{Al saturation of unlimed soil}}$$

Al saturation values were measured at flowering.

two 6-m rows 50 cm apart in a split-plot design with 2 replications. Fifty to 60 seeds/linear meter were used. Grain yield was used to rate tolerance and susceptibility. Tolerance for aluminum toxicity (Al_t) was calculated as:

$$Al_t = \frac{\text{Yield in limed plot} - \text{yield in unlimed plot}}{\text{Difference of Al-saturation without and with lime at flowering}}$$

The yield of the high-aluminum plot and its Al_t are plotted in the figure. Average yield at the high-aluminum level and Al_t were calculated. The diagram is divided into quadrants representing the four groups of cultivars by lines of average yield on high-aluminum plots and average Al_t.

Cultivars that yielded well under high aluminum level and responded well to added lime were: Fernandes, IAC46, Santa Amẽlia, IAC21, IAC1246, IAC1131, KN361-1-8-6, IR2070-199-3-6-6, IAC101, IRAT104, Paulista, IR4727-217-3, IR4227-240-3-2, IAC165, CN770532, CN770527, CN770820, CN770167, CN770610, CN771204, Dular, Pinulot 330, Catão, and Chatão.

Cultivars that produced well under high aluminum level but did not respond to added lime were IRAT13, IAC120, 6 Meses, IAC12, IPSL2060, Grão de Ouro, Rendimentos, Bicudo, Salumpikit, Mogi, Sequeiro do Paraná, IAC5544, EEPG569, IR4829-2-1, IAC5100, Montanha Liso, Pratão Goiano, Seleção Amarelão, CN770867, CN770858, CN770643, CN770614, CN770893, CN770546, CN770602, CN770531, DJ29, AG10-37, IAC5032, and Canta Galo.

Cultivars that produced less under higher aluminum level but responded to added lime were: IAC47, Amarelão, IAC25, Taiwan, Três Potes, Arcos Branco, Baixada, BKN6652-249-1-1, Dourado Precoce, IET6058, C22, Precoce Amarelo, Cana Roxa, Lageado, KN144, IR5793-54-2, C12, Serra Azul, B1293b-PN-24-2-1, H14, IR3483-180-2, IR4707-207-1, IR4227-9-1-6, Azucena, CTG1516, CN770530, CN770191, CN770447, Batatais, Catalão 101, Prata, Taquari, Rondon, Campineiro, and Milagres.

Effect of ferrous sulfate application on rice yield and iron uptake

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A pot culture experiment was conducted on calcareous (pH 8.7, organic carbon 0.56%, $CaCO_3$ 4.7%, and 11.4 ppm DTPA-Fe) and noncalcareous (pH 8.5, organic carbon 0.17%, $CaCO_3$ 0.25%, and 8.7 ppm DTPA-Fe) soils (Aeric Fluvaquent) during summer 1979 to study the effect of $FeSO_4 \cdot 7H_2O$ soil applications (0, 15, 30, and 60 ppm) on the yield and Fe uptake of rice in submerged conditions.

Grain yield increased 35% at 15 ppm and 70% at 30 ppm added Fe for calcareous soil and 100% and 200% for noncalcareous soil (see table). Straw yield increased significantly up to 15 ppm added Fe in noncalcareous soil and up to 30 ppm in calcareous soil. The significant decrease in yield at higher rates may be attributed to the antagonistic effect of Fe on the availability of other nutrients. Fe application of up to 30 ppm increased Fe uptake in straw and grain in both soils. Uptake in grain continued to increase up to 60 ppm Fe in calcareous soil. Total Fe uptake was greater in calcareous soil than in noncalcareous soil, which was the reverse of yield trends.

Effect of different rates of iron on dry matter yield (grain and straw) and iron uptake by PR-106, Punjab, India.

Rate of iron (ppm)	Yield (g/3-kg pot)				Iron uptake (mg/3-kg pot)			
	Calcareous soil		Noncalcareous soil		Calcareous soil		Noncalcareous soil	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
0	1.7	5.4	1.7	10.1	0.27	2.85	0.22	1.79
15	2.3	7.9	3.4	14.0	0.44	3.52	0.52	3.32
30	2.9	11.3	5.1	11.7	0.74	7.06	1.04	4.43
60	2.5	9.0	2.8	10.4	0.98	5.92	0.53	2.32
C.D.(0.05)	0.4	1.0	0.5	1.7	0.17	0.49	0.19	0.34

Effect of phosphorus fertilization and soil moisture regimes on phosphorus content of rice crop

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Different phosphorus (P) application rates were tested for their effect on rice plant P concentrations at different development stages and moisture regimes. Soils from 4 areas in Assam, India, were studied in the greenhouse at 3 levels of applied P: 0, 26.4 kg, and 52.8 kg/ha (Table 1). Moisture regimes

Table 1. Characteristics of 4 acid soils in Assam, India.

Soil	pH	Texture	Organic carbon (%)	Total P (ppm)	Available P (kg/ha)
Dergaon	5.0	Sandy loam	0.93	875	4.2
Golaghat	4.3	Clayey	1.57	1000	3.8
Tengakhat	4.5	Sandy loam	1.53	1563	3.9
Titabar	4.9	Clayey	1.33	1250	2.3