(DAI), surviving insects were transferred to freshly treated seedlings. Inoculated seedlings were transplanted in seedboxes for disease development. Successive inoculation feeding continued up to 5 d. RTV symptoms were observed at 20 DAI.

GLH survival decreased significantly after 2-d exposure to systemically treated plants. Although survival of GLH exposed to foliar NSB-treated seedlings was not significantly different from check, ability to transmit RTV was significantly lower than that of untreated seedlings (see table).

Survival of GLH females and RTV transmission after 5 d exposure to TN1 rice seedlings treated with 2,500 ppm NSB.[a] IRRI, 1987.

Treatment	GLH survival (%)				RTV infection (%)	
	1d	2d	3d	5d	1d	2d
Foliar	95 a	91 b	84 b	69 b	38 b	8 a
Systemic	90 a	74 a	69 a	51 a	17 a	4 a
Check	95 a	89 b	84 b	74 b	65 c	22 a

[a]Av of 5 replications, 30 GLH and 30 TN1 seedlings/replication. In a column, means followed by a common letter are not significantly different at the 5% level by DMRT.

Systemic NSB application was best against RTV transmission. RTV transmission efficiency of the vector became negligible after 2d inoculation feeding in check as well as in treated plants. □

Compatible insecticides and fungicides to control leaffolder (LF) and sheath rot (ShR) in rice

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We studied the compatibility of commonly used insecticides phosphamidon, monocrotophos, and chlorpyrifos with popular fungicides edifenphos, mancozeb, and carbendazim during 1985-86 and 1986-87. Field trials consisted of 10 treatments replicated 3 times. In both years, 25-d-old Co 43 seedlings were planted in 10-m^2 plots at 20- × 10-cm spacing. Combined sprays were applied at 20, 40, and 60 d after transplanting.

Only rice LF and ShR occurred during the study. In both years, combined spraying of monocrotophos with any one of the three fungicides was the most effective treatment, keeping LF infestation well below economic injury level (<5%). In 1986-87, combined spraying of monocrotophos with carbendazim resulted in the lowest incidence of ShR (see table).

In both years, combined spraying of monocrotophos with the three fungicides resulted in the highest yields. □

Efficacy and compatibility of insecticides and fungicides in the control of rice pests and diseases. Rice Research Station, Tirur, India, 1985-86 and 1986-87.

Treatment	1985-86		1986-87		
	LF-damaged leaves (%)	Grain yield (t/ha)	LF-damaged leaves (%)	ShR infected tillers (%)	Grain yield (t/ha)
Phosphamidon 250 ml/ha + edifenphos 500 ml/ha	29	3.1	15	7.0	4.2
Phosphamidon 250 ml/ha + mancozeb 1000 g/ha	19	3.0	14	6.6	4.1
Phosphamidon 250 ml/ha + carbendazim 250 g/ha	32	2.8	16	8.2	3.8
Monocrotophos 500 ml/ha + edifenphos 500 ml/ha	4	3.4	2	6.0	4.5
Monocrotophos 500 ml/ha + mancozeb 1000 g/ha	3	3.6	3	6.0	4.2
Monocrotophos 500 ml/ha + carbendazim 250 g/ha	3	3.2	2	4.9	4.2
Chlorpyrifos 500 ml/ha + edifenphos 500 ml/ha	11	3.1	7	7.0	4.2
Chlorpyrifos 500 ml/ha + mancozeb 1000 g/ha	15	2.8	9	6.2	3.9
Chlorpyrifos 500 ml/ha + carbendazim 250 g/ha	17	2.9	25	5.6	4.0
Control	63	2.7	77	13.5	3.1
CD (P=0.05)	5.0	1.5	15.4	5.5	0.4

Brown planthopper (BPH) outbreak in Thanjavur District, Tamil Nadu

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During the Jun-Sep 1987 drought due to failure of the monsoon, a BPH out break in Sivapurani, Kondasamudram, and Kurichi villages of Kumbakonam division, Thanjavur District, caused typical hopperburn symptoms on IR50. Approximately 100 ha were affected. Farmers applied double the recommended N as basal fertilizer. Because the insecticides used were not directed toward the base of the plants, control was inadequate. Furthermore, the farmers sprayed quinalphos, a resurgence causing insecticide, which aggravated the pest population.

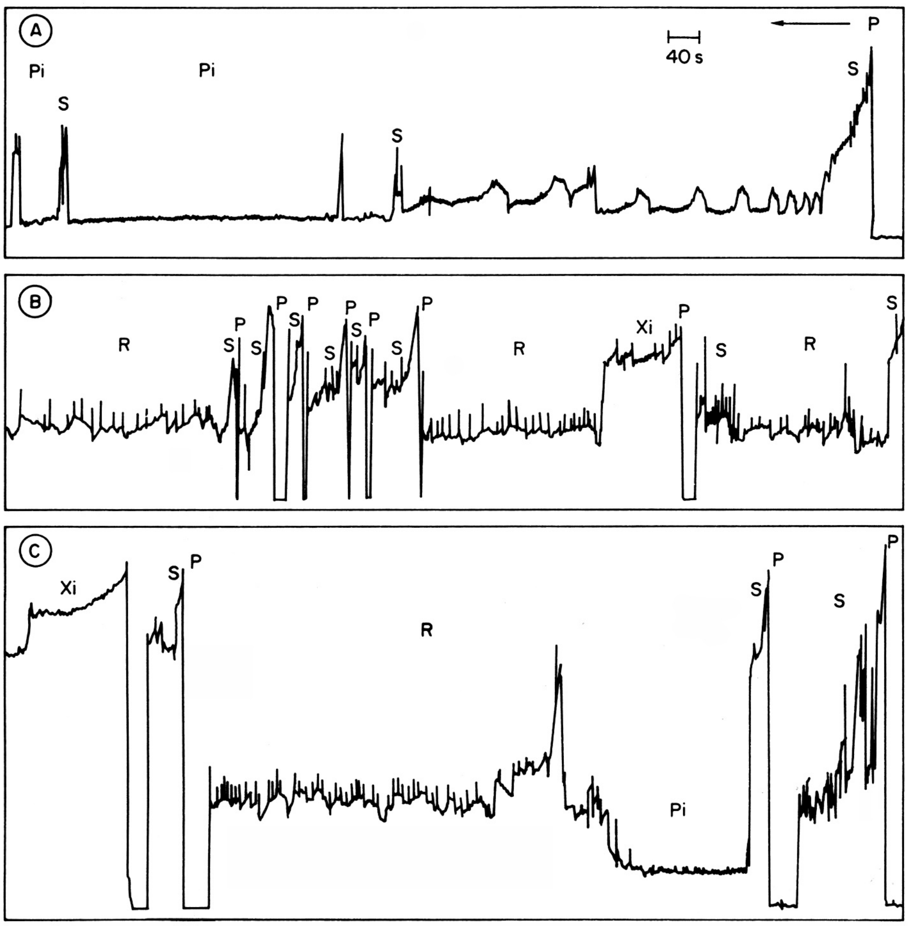
Unsprayed fields recorded 56 hoppers/hill; phosphamidon-sprayed fields had 8 hoppers/hill. Where quinalphos was sprayed, populations exceeded 250 hoppers/hill. Populations of natural enemies like mirid bug, wolf spider, and coccinellid beetles were higher in unsprayed fields. □

Effect of neem seed bitters (NSB) on green leafhopper (GLH) feeding

R. C. Saxena and M. E. M. Boncodin, Entomology Department, IRRI

A simple process has been developed at IRRI to extract the "bitters" (limonoids) from neem seed kernel. Using an electronic device, we monitored the feeding behavior of newly emerged GLH *Nephotettix virescens* females on 21-d-old TN1 rice seedlings that had been treated systemically by overnight root immersion or by dipping the foliage in a 2,500 ppm NSB aqueous solution for 25 s.

During a 3-h observation, waveform patterns (see figure) showed that duration of phloem feeding was significantly reduced in neem-treated seedlings (see table). The decrease in phloem feeding was accompanied by a corresponding significant increase in frequency of probing, salivation period, and xylem feeding. If GLH feeds less in the phloem, it has less probability of acquiring or transmitting tungro viruses. □



Waveforms electronically recorded during *N. virescens* feeding on TNI rice plants, IRRI, 1987. a = control, b = 2500 ppm NSB-systemic, c = 2500 ppm NSB-foliar. P = probe, S = salivation, Pi = phloem ingestion, R = rest, Xi = xylem ingestion.

Events in 3-h feeding by *N. virescens* females on TN1 rice seedlings treated with 2,500 ppm NSB solution.[a] IRRI, 1987.

Treatment	Probes (no .)	Salivation (min)	Phloem ingestion (min)	Xylem ingestion (min)	Total ingestion (min)
Systemic	25 a	20.7 a	27 b	23 a	50 a
Foliar	24 a	15.2 ab	33 b	27 a	60 a
Control	13 b	9.6 b	77 a	1 b	78 a

[a]Av of 10 replications. In a column, means followed by a common letter are not significantly different at the 5% level by DMRT.

Effect of neem seed treatment on rice seedling vigor and survival of brown planthopper (BPH) and green leafhopper (GLH)

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The principal bitters of neem, particularly azadirachtin, are known to be systemically translocated through the roots. We evaluated seed treatment with crude neem seed kernel extract (NSKE) or neem cake (NC) as a BPH or GLH control measure for young seedlings. We also measured the effect of neem treatment on seed germination and seedling vigor.

In one treatment, healthy seeds of TNl, IR36, and IR42 were soaked in 2.5, 5, or 10% aqueous NSKE solution for 24 h, then incubated for 48 h. In

Table 1. Effect of seed treatment with crude NSKE and NC on BPH and GLH survival.[a] IRRI, 1987.

Neem concentration (%)	Nymphs becoming adults (%) BPH on TN1	GLH on TN1	GLH on IR42
NSKE			
2.5	46.7 b	57.0 b	6.7 a
5.0	63.3 cd	44.3 b	10.0 a
10.0	30.0 a	6.7 a	10.0 a
NC			
1.0	50.0 bc	50.0 b	6.7 a
2.0	30.0 a	30.0 b	13.3 a
0 (check)	70.0 d	70.0 b	36.7 a

[a]Av of 3 replications, 10 first-instar nymphs/ replication. In a column, means followed by the same letter are not significantly different at the 5% level by DMRT.