fully placed over a rice hill and insects are sucked into the container by moving the transparent hose by hand over the plant and water surfaces (see photo). After the machine is turned off, the plastic drain cap is removed and the machine is tipped to drain off any water sucked in. The wire hooks are released, the container is slipped off the rubber stopper, alcohol is squirted into the container, and the newly preserved insects are collected in the removable collection bottle.

The materials needed to construct a FARMCOP suction sampler (excluding batteries) cost about $40, much less than the price of commercial motorized sampling machines. An important feature is that it can sample arthropods on the surface of paddy water. But it is convenient to have two men rather than one man operating the FARMCOP. It requires about twice as much time for sampling as the D-VAC sampler, and the batteries must be recharged frequently.

Density in transplanted rice of brown planthoppers and predators ripple bugs *Microvelia atrolineata* and spiders *Lycosa pseudoannulata* determined by different sampling techniques.[a] IRRI, 1979.

Sampling technique	Brown planthoppers (no./5 hills)			Ripple bugs (no./5 hills)		Ripple bugs (no./5 hills)	
	Nymphs	Adults		Nymphs	Adults	Juveniles	Adults
	34 DT[b]	34 DT	55 DT	83 DT	83 DT	83 DT	83 DT
FARMCOP[c]	22 a	24 b	13 a	216 a	224 a	68 a	8 a
D-VAC[c]	8 b	48 a	6 a	51 b	184 ab	28 b	4 b
UNIVAC[c]	2 c	25 b	9 a	20 c	64 bc	19 b	8 a
Visual count	1 c	14 b	8 a	32 bc	32 c	9 b	3 b
Mouth aspirator[c]	2 c	17 b	6 a	0 d	0 d	15 b	5 b

[a]In a column means followed by the same letter are not significantly different at 5% level. [b]DT = days after transplanting. [c]Using enclosure.

Great care must be taken to prevent damage to maturing plants when the enclosure is placed over them.

Samples taken in wetland rice by the FARMCOP, the large D-VAC and UNIVAC suction machines, a mouth aspirator, and visual counting were compared. FARMCOP almost always gave the most accurate densities of brown planthopper nymphs and predators such as ripple bugs and spiders. But its estimate of adult hopper density is not the best (see table). Therefore it is necessary to place a cover over the enclosure during the initial phases of sampling a hill to prevent escape of active adults.

Individuals interested in FARMCOP construction details and operating instructions should write to the Entomology Department, IRRI. ■

Flight capabilities of the brown planthopper

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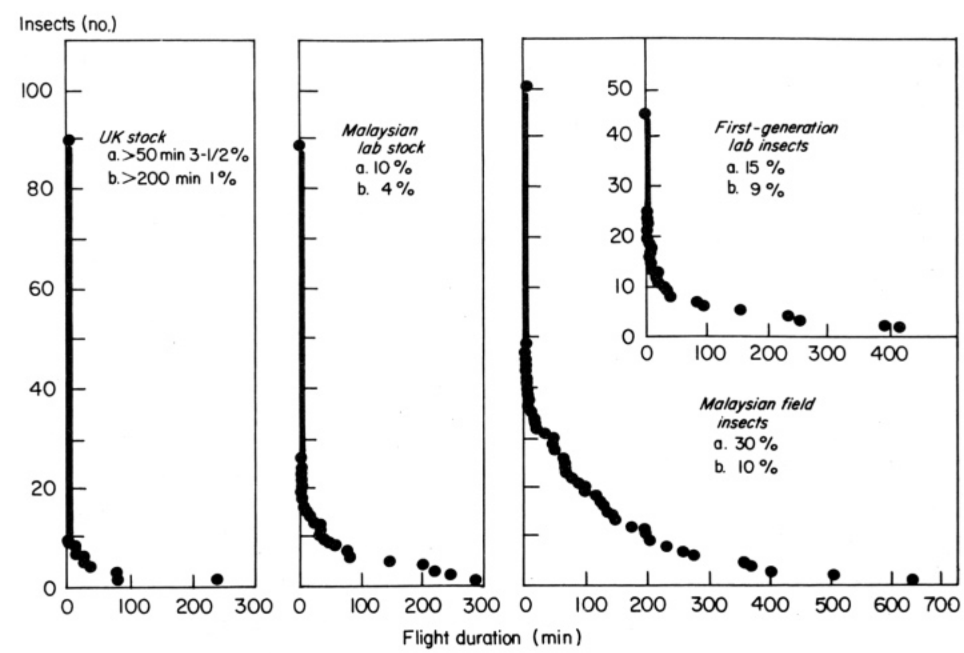
The brown planthopper (BPH) *Nilaparvata lugens* migrates from China and Korea to Japan each spring. There has been much speculation as to whether the BPH in the tropics make migratory flights. The flight capabilities of a field population of BPH were studied at a Malaysian field site in June and July 1978 and the results were compared with those obtained in the COPR laboratory in London.

The adult field insects used developed from late-instar hoppers taken into the laboratory on mature plants removed from naturally infested paddy fields. The laboratory-reared insects came from three sources: 1) BPH stock, of Japanese origin, held in the UK for more than 2 years, 2) caged insects held near the field site for a number of generations, and 3) first-generation adults reared from eggs laid by the field adults brought back to and reared in London. All insects



Numbers of insects and flight duration. Percentage figures refer to all insects tested (including nonfliers).

were flown in still air (36–30°C, 80–85% relative humidity, 1,000–2,000 lux) on simple flight balances that indicated the amount of lift being produced. The figure summarizes the experimental results for flight duration. Percentages refer to all macropterous insects tested and therefore include nonfliers. The proportion of field-reared insects that flew for more than 200 minutes was larger than that of any other group.

Two points are of interest. First, the results may serve as a warning to other behaviorists and physiologists working on the BPH that even first-generation laboratory insects respond differently from field-reared insects, at least in flight performance. Second, the tropical field population contained a proportion of adults capable of sustaining flights of long duration. Questions to be answered include whether, how often, and under what conditions the BPH exploits this capability. ■

Soil and crop management

"Catch" crops for summer annual fallow

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Eight crops were evaluated to determine the most suitable as a local summer annual (catch) crop after winter rice. The experiment was in a replicated randomized block design and was continued for 3 seasons (1976-78). The test crops included sesame (locally called gingelly) — the traditional catch crop in the area — as well as short-duration tapioca, groundnut, cowpea, sweet potato, mung bean, finger millet, and black gram. During early growth the crops depended on residual soil moisture and, later, on occasional summer showers.

Performance of crops in summer rice fallow. Kayamkulam, Kerala, India, 1976-78.

Crop	Duration (days)	Yield[a] (t/ha)	Returns[b] (US $/ha)
Tapioca[c]	103[d]	13.5	487
Groundnut	103	2.8	842
Cowpea	67	0.6	206
Sweet potato	103[d]	2.8	132
Mung bean	66	0.2	61
Finger millet	103	0.5	123
Sesame	76	0.3	119
Black gram	78	1.3	394

[a]Mean for 3 seasons. [b]In terms of the prevailing Kerala market rate. [c]Grown in only 1 season. [d]Harvested before full maturity.

Groundnut gave the highest returns (see table). Although it matures 20 to 25 days later than sesame, it can easily fit into the region's current cropping pattern. The 110-day interval between the winter and autumn rice crops is sufficient for a crop of 103 days duration. Tapioca and sweet potato require more than 110 days to mature.

The growth durations of black gram and cowpea are similar to that of sesame; their input costs are low and their returns relatively high. Hence for the local summer rice fallow, groundnut, black gram, and cowpea can be used as summer annual catch crops. ■

Improved management practices for raising boro seedlings

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Cold temperature in the boro season (min, 10-12°C) retards and stunts the growth of seedlings, especially of modern rices, even if transplanting is delayed to 60 days after sowing. BRRI experiments indicate that improved seedbed management involving the use of farm-yard manure and night cover during the cold season can produce more vigorous seedlings. When transplanted at 30 or 45 days after sowing, such seedlings were taller, had higher dry matter production, and lower mortality. They produced higher yields in a shorter growth period than conventionally grown seedlings. ■

Root distribution and root biomass production of rice under different soil water regimes in Entisols of northern India

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Rice plants were grown in the greenhouse under four water management regimes: a) saturation (0-0.1 atm) throughout crop growth, b) saturation up to maximum tillering and flooding up to ripening, C) flooding up to maximum tillering and saturation up to ripening. and d) continuous flooding (water depth of 3 ± 5 cm) throughout crop growth. Plants were spaced 40 cm apart to keep their roots separate.

Horizontal root growth (distance between the plant base and the farthest root cores around the hill) was measured. Cores were taken from various lateral zones around the plant with a 2-cm-diameter core sampler. The roots were spray washed and separated from the cores.

The water management practices at the initial vegetative phase affected root distribution and root mass production

Root distribution and biomass of rice under 4 water regimes in Entisols, Varanasi, India.

Water regime	Root color	Intensity of distribution	Lateral spread (cm)	Vertical spread (cm)	Root biomass production (g/hill)
Continuous saturation	Deep brown	Sparse	13	26	12.2
Saturation + flooding	Brown	Less abundant	14	23	13.2
Flooding + saturation	Light brown	Abundant	16	18	15.6
Continuous flooding	Lighter brown	Dense mat	16	16	18.1