

summer rice (Feb–May) in 1980 and 1981. No rice varieties grown was found to be resistant. A trial to evaluate six granular insecticides was conducted during 1981 summer.

The trial was laid out in a randomized block design with three replications. Pest-susceptible cultivar Suphala (TN1/T141) was transplanted on 21 Feb 1981. Insecticide granules at

1.5 kg ai/ha were broadcast at 15 and 35 d after transplanting, when heavy migratory hopper populations appeared. BPH adult and nymph populations were recorded at 10 and 20 d after treatment (DAT) on a random sample of 10 hills after each application.

Heavy adult population was recorded at 10 DAT, increasing up to

20 DAT with a continuous influx of emigrant hoppers. Hopperburn was noticed with phorate, quinalphos, and disulfoton treatments, resulting in a total yield loss (see table).

The superiority of isoprocarb, carbofuran, and BPMC was evident 10 d after the second treatment, with a significant reduction in nymph population. □

Insect pests of wet season rice in Jabalpur, India

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Wet season rice grown after wheat in Jabalpur is attacked by several insect pests. In a 1984 survey, whitebacked planthopper was a major pest at the vegetative stage, 8–107 hoppers/hill (see table). Rice hispa, although sporadic, was 0.3–12/hill and caused 17–28% damaged leaves.

Rice whorl maggot damage was recorded in this region for the first time during that survey with 5% damaged leaves in early August, increasing to 16%. Populations of rice armyworm started at 0.2 larva/ hill and

Insect pests of rice at Jabalpur, India, 1984.

| Pest | Economic status ^a | Damage or population ^b |
|--|------------------------------|--|
| Whitebacked planthopper <i>Sogatella furcifera</i> (Horvath) | Major (R) | 107 hoppers/hill Jul planting |
| Rice hispa <i>Dicladispa armigera</i> (Olivier) | Major (S) | 12 hispas/hill and 28.3% leaf damage in Jul planting |
| Rice whorl maggot <i>Hydrellia philippina</i> Ferino | Minor | 16% leaf damage in Jul planting |
| Rice armyworm <i>Mythimna separata</i> (Walker) | Major (R) | 1.8 larvae/hill in Jul- Aug planting |
| Rice green leafhoppers <i>Nephotettix</i> spp. | Minor (R) | 1–3 hoppers/hill |
| Yellow stem borer <i>Scirpophaga incertulas</i> (Walk.) | Minor (R) | 1.4% deadhearts |
| Rice satyrid butterfly <i>Melanitis leda ismene</i> (Cramer) | Minor (S) | Traces |
| Rice gundhi bug <i>Leptocoris acuta</i> (Thunberg) | Minor (S) | 1–2 bugs/hill |

^aR = regular, S = sporadic, ^bPeak population or damage during season.

reached 2 larvae/hill. The 1.3 larvae/ hill during the first week of Oct coincided with booting and panicle development. That population was higher than the economic threshold level of 1 larva/hill.

Trace numbers of yellow stem borer, rice skipper *Pelopidus* sp., rice satyrid butterfly, and rice gundhi bug *Leptocoris acuta* (Thunberg) [=varicornis (Fab)] were found. □

Biogas to control rice storage pests

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The major insect pests of stored rice are the Angoumois grain moth *Sitotroga cerealella*, the lesser grain borer *Rhizopertha dominica*, and the rice weevil *Sitophilus oryzae*. We tested controlling these pests with biogas from cow dung, consisting of 60% methane, 30–35% carbon dioxide, and traces of other gases.

Effect of biogas on rice storage pests.

| Insect | Biogas dose | Time to 10% mortality | |
|----------------------|---------------|-----------------------|------------|
| | | Without grain | With grain |
| <i>S. cerealella</i> | 20 liters/min | 30 s | 4 h |
| <i>S. oryzae</i> | 20 liters/min | 35 s | 4 h 50 min |
| <i>R. dominica</i> | 20 liters/min | 50 s | 6 h |

Twenty-five adults of each pest were placed in 1-kg-capacity closed glass containers and subjected to biogas at 20 liters/min, at 28°C room temperature and 80% relative humidity. Within 30–50 s, all test insects died. No insects died in the untreated check.

Test insects were subjected to 20 liters biogas/min in the presence of 1 kg rough rice. The time to 100% death was 4–6 h (see table). *S. cerealella* was easily killed, followed by *S. oryzae* and finally *R. dominica*. The same treatment also was highly effective in controlling rats. □