Technical notes

Evaluation of insecticidal treatments against black field earwig, *Nala lividipes* (Dufour), in maize

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Summary

Insecticidal treatments against *Nala lividipes* (Dufour) in maize were evaluated in a trial carried out at Emerald, Queensland, during 1984. Chlorpyrifos baits were more effective than seed or soil treatments in reducing seedling losses and lodging. This was probably due to reduced N. *lividipes* activity.

Introduction

For many years, the black field earwig, *Nala lividipes* (Dufour), has caused losses in field crops in south-east Queensland (Hargreaves 1970, Broadley and Ironside 1980) and recent serious infestations have occurred in summer crops throughout central Queensland. Adults and nymphs feed on the germinating seed and seedlings, causing establishment problems and resowing is required if infestations are heavy. In maize and sorghum, plant losses occur up to 8 weeks after sowing as damage to secondary prop roots results in plants being blown over by wind (lodging). These losses are aggravated if conditions remain dry after sowing.

Attempts to control *N. lividipes* have had mixed success. Radford and Allsopp (1987) demonstrated the importance of press wheels for improved establishment of both sorghum and sunflower on the Darling Downs. Heptachlor seed dressing at 0.8 g a.i. kg^{-1} seed also improved establishment, but heptachlor is now banned for agricultural use in Australia. Insecticides in combination with press wheels at 4 N mm^{-1} were little improved over press wheels alone in the establishment of sorghum on the Darling Downs (Allsopp and Radford 1987). Observations in central Queensland suggested that the standard seed dressing of chlorpyrifos at 0.4 g a.i. kg^{-1} for the control of false wireworm larvae was unsatisfactory against *N. lividipes.* An in-furrow spray of chlorpyrifos at 0.5 g a.i. and 10 L water 100 m row^{-1} was recommended for *N. lividipes* control in maize in Queensland (Swaine and Ironside 1983).

Insecticide treated cracked grain baits were recommended for the control of a number of soil-dwelling insect pests in summer crops in Queensland (Murray and Spackman, 1983), but these had not been tested against *N. lividipes.* Our trial was intended to evaluate the baiting method and to compare it with other sowing treatments currently in use.

Materials and methods

The experiment was conducted during 1984 on a heavy self-mulching black earth clay at Emerald, central Queensland. The site was selected because a previous maize planting suffered severe seedling damage. *N. lividipes* was identified as the major cause of these losses. Because of their rapid movement in the soil and the difficulty of efficient sampling, especially when the soil is wet (Robertson and Simpson 1989), *N. lividipes* population estimates were not determined.

Seven treatments (Table l) were replicated four times for maize (cv. DeKalb XL81) in a randomized complete block design. Each plot consisted of four 12.25 m lengths of row sown 1 m apart using a four row cone planter. Sowing rates were approximately 108 seeds 20 m row^{-1}. Press wheels at a pressure of 4 N mm^{-1} wheel width were used for

Table 1. Effect of insecticidal treatments against black field earwig on maize establishment and survival at Emerald.

Treatment	Mean No. plants 20 m row^{-1} Weeks after sowing			Percentage of plants surviving week 2 to week 6	Percentage ofplants lodged at 6 weeks	
	2	4	6		*trans.	equiv.
Control	105.5	94.8ab	92.0ab	86.8a	4.54a	20.1
Chlorpyrifos seed dressing (40 g a.i. 100 kg $seed^{-1}$)	109.5	99.8ab	97.5abc	89.2ab	4.32a	18.2
Chlorpyrifos in-furrow spray(2.5 g a.i. +2.5 L water 100 m row^{-1})	109.0	102.3bc	102.0bc	93.5abc	3.94a	15.1
Chlorpyrifos water injection(1.0 g a.i. +3.2 L water 100 m row^{-1})	104.5	94.8ab	92.0ab	88.1a	3.83a	14.2
Chlorpyrifos seed soaking(40 g a.i. 100 kg $seed^{-1}$)	102.5	89.5a	87.8a	85.7a	3.83a	14.2
Bait trail over row (25 g 100 m row^{-1})	108.5	107.8c	106.8c	98.0bc	1.77b	2.6
Bait broadcast (2.5 kg ha^{-1})	107.0	106.5c	107.0c	99.8c	1.72b	2.5
S.E.M.	2.0	2.9	3.6	3.2	0.54	

* Transformation ($\sqrt{(x + 0.5)}$) Means in any column followed by the same letter are not significantly different at 5% level. No letters indicate non-significance.

all treatments.

Seed-dressing treatments used a chlorpyrifos wettable powder formulation (as Lorsban 250W) while all other treatments used a chlorpyrifos emulsifiable concentrate formulation (as Lorsban 500EC). Seed dressing and seed soaking treatments were prepared 24 hours prior to sowing and water injection and in-furrow spray treatments were applied at sowing. A flat fan nozzle (Spray Systems 8001E) adjusted to give a 10 cm band was placed immediately behind the planting tine for the in-furrow spray.

Immediately after sowing, baits were applied by hand shakers. A standard bait recipe containing 2.5 kg cracked sorghum, 125 mL sunflower oil and 100 mL chlorpyrifos (500 g L^{-1} formulation) was used for bait treatments.

Plots were assessed 2, 4 and 6 weeks after sowing by recording the number of plants in the centre two 10 m lengths of row per plot. Counts of lodged maize plants were made six weeks after sowing when the plants were about 30 cm high.

The numbers of plants 20 m row^{-1} 2, 4 and 6 weeks after sowing and the percentage of plants surviving from week 2 to week 6 were analysed separately as untransformed data in a two way analysis of variance. The percentage of lodged plants at week 6 were transformed ($\sqrt{(x + 0.5)}$) and similarly analysed. Significance was tested at the 5% level using Duncan's new multiple range test.

Results and discussion

Significant treatment effects on maize seedling establishment were recorded 4 and 6 weeks after sowing, but initial establishment 2 weeks after sowing was similar across all treatments (Table 1). These data suggest that in this experiment insect attack during germination and early emergence was relatively unimportant. This effect may have been due to the use of press-wheels in all treatments. Press-wheels improve establishment whenever an earwig population is known to be present or a field has a history of such infestation (Allsopp and Radford 1987).

Both row and broadcast bait treatments improved maize plant survival. Lodged plants were recorded in all treatments, though significantly less in the bait treatments. Since lodged plants usually die, especially in dry conditions, greater reductions in plant counts could be expected in these treatments when compared with the bait treatments.

These results indicate that baiting effectively reduced insect damage to maize. In the control plots, secondary prop roots were stunted and root tips were chewed. Such damage is characteristic of *N. lividipes*. They were the only soil insect pest detected around the base of damaged seedlings. It is suggested that baiting reduced *N. lividipes* activity and prevented crop damage. While 2.5 kg bait ha^{-1} were satisfactory in this experiment, commercial application has subsequently demonstrated 4 to 5 kg ha^{-1} broadcast immediately after planting was efficacious. Chlorpyrifos seed soaking, seed dressing and water injection, were each unsatisfactory in reducing damage to maize. Phytotoxicity was observed in the seed soaking treatment and probably resulted in the lower plant counts for this treatment. The demonstration that chlorpyrifos baits reduced damage to maize caused by *N. lividipes* adds to the usefulness of these baits for control of a wide variety of soil insects, and will contribute towards improved summer crop establishment in central and southern Queensland.

References

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