INSECTICIDE CONTROL OF GRASS GRUB LARVAE IN SWEDES

R.F. VAN TOOR and K.M. STEWART

*Agricultural Research Division, MAF, Gore and
Invermay Agricultural Research Centre, MAF, Mosgiel*

SUMMARY

In two field trials in Southland, insecticide granules of lindane, fensulfothion, diazinon, terbufos and phorate were drilled at 1 kg ai/ha with swede seed. In one trial insecticide reduced grass grub (*Costelytra zealandica*) numbers by up to 70%. By late summer increases in herbage and bulb yields occurred at each site. Where soil fertility was low and weeds competed during swede establishment, differences persisted into winter to give bulb increases of up to 1 T DM/ha (31%). A commercial seed dressing (Prillcote) which included lindane did not reduce grass grub numbers significantly but increased herbage yield in late summer at one site.

INTRODUCTION

Damage to brassicas in spring, caused by grass grub with a 2 year life cycle, occurs occasionally within Southland and Otago and is particularly prevalent in the Wendonside and Te Anau districts. When brassica crops are sown in spring, 2 year larvae are present as second or young third instars actively feeding on plant roots (Stewart 1975). Severe damage to brassica crops can occur if larval densities are high.

While there has been a strong trend in Southland towards all-grass farming, brassicas remain an important source of food in winter for sheep on the lighter soils, and to a lesser extent for fattening lambs in late summer.

This paper reports on the effectiveness of five insecticides in protecting swedes from damage by 2 year grass grub. Application was either as granules drilled with the seed, or as a commercial insecticide/fungicide seed coat.

METHODS

Two trials were laid down at Wendonside, Northern Southland, on an Oreti stony silt loam (N.Z. Soil Bureau 1968). The paddocks were cultivated out of pasture prior to sowing. Details of sowing dates and treatments are shown in Table 1. Untreated Doon Major swede seed had a 14 day germination of 95% in the laboratory. Seed at 1.5 kg/ha mixed with granules of each insecticide (rates in Table 1) was sown by an "Oyjord" cone seeder. In addition Prillcote Superstrike Doon Major seed coated with captan and thiram fungicides and lindane insecticide was sown at 7.8 kg/ha to give a common sowing rate of 42 viable seeds/m² for each treatment. The coated seed had a laboratory germination of 87%.

Treatments in plots 1.4 m × 10 m were replicated six times as a randomised block design.

Management

Three weeks after sowing in Trial 1 and 1 week after sowing in Trial 2, 250 kg di-ammonium phosphate/ha containing 45 kg N was broadcast over all plots. Later when crops were established 30 kg N/ha was applied as calcium ammonium nitrate. Weeds were not a problem in Trial 2 but in Trial 1 plots were weeded by hand on 23 January 1984 to remove severe competition from Californian thistle (*Cirsium arvense*) and spurrey (*Spergula avensis*). Since springtails (*Bourletiella hortensis*) were present, maldison insecticide was sprayed at 0.12 kg ai/ha over each trial area.

Proc. 38th N.Z. Weed and Pest Control Conf.

Measurements

Grass grub populations were estimated immediately prior to sowing by extracting grubs from 30 soil samples $16 \times 16 \times 30$ cm deep spaced regularly over the trial area. Treatment effects on grubs were again estimated by extraction from 12 soil samples per plot on 2 February 1984 for Trial 1 and 22 March 1984 for Trial 2. The larvae were then weighed on each occasion to measure any differences between treatments.

By sampling three quadrats 1×0.5 m/plot, plant numbers were counted 11 and 28 days after sowing to estimate field germination and establishment; and estimates of plant density, herbage and clean bulb yield were made 13 weeks after sowing at early harvest on 23 February in Trial 1 and on 14 March in Trial 2 and at final harvest on 19-20 June about 3 weeks after the start of grazing of swedes in Southland. The final herbage harvest in Trial 2 was not sampled due to accidental grazing.

RESULTS**Soil fertility**

Initial soil phosphorus and potassium levels were lower in Trial 1 than in Trial 2: 7 ppm Olsen P and 20 ppm exchangeable K cf. 10 and 80 respectively.

Grass grub control

At sowing, young third instar grass grubs were present at $144/\text{m}^2$ (SEM 20) in Trial 1 and $120/\text{m}^2$ (SEM 21) in Trial 2.

TABLE 1: The effect of insecticides on mortality of grass grub and on swede herbage and bulb yields at early and final harvest in two trials. Means of larvae/m² are log_e transformed with back-transformed means in brackets.

Trial 1 Sown 22 November 1983						
Treatment	Concn. %	Rate kg ai/ha	2 February (larvae/m ²)	23 February Herbage (kg DM/ha)	23 February Bulb (kg DM/ha)	19 June Bulb (kg DM/ha)
untreated			3.69 (40)	2091	651	3070
lindane	20	1.0	3.09 (22)	2382	723	3495
fensulfothion	5	1.0	2.50 (12)	2612	813	4044
phorate	20	1.0	2.86 (17)	2972	968	3857
terbufos	20	1.0	2.71 (15)	2534	812	3584
diazinon	5	1.0	2.71 (15)	2638	887	3939
Prillcote (lindane)	5	0.4	3.31 (27)	2187	740	3333
LSD 5%			0.94	441	226	777
Trial 2 Sown 13 December 1983						
			22 March larvae	14 March Herbage	14 March Bulb	20 June Bulb
untreated			4.13 (62)	4953	2258	8048
lindane	20	1.0	3.30 (27)	5807	2576	7669
fensulfothion	5	0.5	3.51 (33)	5993	2703	7295
fensulfothion	5	1.0	3.49 (33)	6147	2540	8130
phorate	20	1.0	3.39 (30)	6500	2962	8273
terbufos	20	1.0	3.84 (46)	5651	2615	8268
diazinon	5	1.0	3.51 (33)	5678	2390	7998
Prillcote (lindane)	5	0.4	3.40 (30)	5957	2308	7839
LSD 5%			1.20	690	326	1024

Grub populations declined naturally to low numbers before the early harvest by which time each insecticide treatment had given similar control of larvae at each site (Table 1). Fensulfothion, phorate, diazinon and terbufos gave significant control in Trial 1 ($P < 0.05$) which averaged 65%. In Trial 2 no significant grass grub control was measured.

The insecticides appeared to selectively control the smaller larvae as the larvae in the untreated plots of Trial 1 were 11% lighter in weight ($P < 0.05$) than larvae in insecticide treatments. There was evidence of a difference in larval weights in Trial 2 but it was not significant.

Swede yield

The insecticides in Trial 1 apparently had an initial phytotoxic effect with 15% lower establishment 17 days after sowing ($P < 0.05$), but 11 days later plant numbers in treated and untreated plots were similar presumably because plants were protected from damage by grubs. No differences were apparent in Trial 2.

At the early harvest each insecticide except lindane led to increased herbage yield in one or both trials and phorate, terbufos and diazinon increased bulb yields. Fensulfothion, phorate and diazinon significantly increased final yields only in Trial 1 (Table 1). At the early harvest phorate resulted in significantly higher total yields (herbage + bulbs) than the other combined granule treatments in each trial ($P < 0.05$). In Trial 2, 1.0 kg ai/ha of fensulfothion was not significantly better than the 0.5 kg ai/ha at early or final harvest.

Although Prillcote-treated seedlings were stunted at both sites 1 month after sowing, there was no early harvest reduction in yields apparent in Trial 1, while in Trial 2 an increase in herbage resulted (Table 1); final yields were apparently not improved.

Grub/swede relationship

The regression of early harvest swede yield (Y) in yield tonne DM/ha on $\log_e$ grub density (X) in Trial 1 gave the equations $Y = 5.07 - 0.87X$ ($P < 0.001$) for herbage and $Y = 1.92 - 0.37X$ ($P < 0.001$) for bulbs indicating that an increase in larval density from 10/m² to 40/m² resulted in a 39% loss in herbage, and a 48% reduction in bulb yield. In Trial 2 no correlations or trends were detected ($P > 0.05$).

DISCUSSION

Grass grub damage to swedes took the form of reduced growth rather than reduced numbers of plants. Only in Trial 1 did the effects of some insecticides persist into winter. This was probably because the higher soil fertility in Trial 2 allowed more compensatory growth of swedes. In Trial 1 bulb yields in treated plots were 48% lower than the district average of 7.5 t/ha (Drew and Fennessy 1980) whereas in Trial 2, soil nutrient levels and plant growth were more satisfactory.

Unrestricted growth of weeds could have led to a much greater suppression of swede growth in the absence of grass grub control. Yields were favoured by hand weeding of Trial 1 and an abnormally low weed population in Trial 2. In farming practice, grass grub damage to swedes in Southland often leads to severe weed infestations, and the most common species cannot be satisfactorily controlled by post-emergence herbicides (Meeklah 1981).

Phorate gave higher harvest yields than the other treatments although it apparently gave no better grass grub control. Since phorate is currently the cheapest of these materials and is known to control other pests such as aphids and springtails in brassicas (Upritchard and Park 1976) it would seem to be the most suitable for grass grub control in this crop. Reduced application rates of phorate may be worth investigation. In Trial 2 fensulfothion was as effective at 0.5 kg ai/ha as at 1.0 kg ai/ha.

CONCLUSIONS

Prophylactic use of insecticide granules sown with seed is desirable in Southland when densities of 2 year grass grub are over 140/m² prior to sowing. Phorate is recommended. Lindane was inferior whether applied as granules with the seed or when incorporated in a seed coat.

ACKNOWLEDGEMENTS

We thank farmers P. Bowmar and B. Patterson for supplying trial sites, Dr. B.I.P. Barratt for her assistance with field work and in constructive criticism of the manuscript, and Dr. S.F. Crosbie for statistical advice.

REFERENCES

- Drew, K.R. and Fennessy, P.F., 1980. Supplementary feeding. A guide to the production and feeding of supplements for sheep and cattle in New Zealand *N.Z. Soc. Animal Production, Occasional Publication No. 7*, pp 197.
- Meeklah, F.A., 1981. Weed control in brassicas. AgLink FPP 491, Ministry of Agriculture and Fisheries, Wellington.
- N.Z. Soil Bureau, 1968. General survey of soils of the South Island, New Zealand. *N.Z. Bureau Bulletin 27*: 404 pp.
- Stewart, K.M. 1975. Control of grass grub in Otago and Southland. *Proc. 28th N.Z. Weed and Pest Control Conf.*: 255-257.
- Upritchard, E.A. and Park, O.L., 1976. Control of insects in seedling field brassicas with phorate granules. *Proc. 29th N.Z. Weed and Pest Control Conf.*: 193-196.