FURATHIOCARB SEED TREATMENT FOR THE CONTROL OF SPRINGTAILS ON SEEDLING BRASSICAS

P.J. ADDISON¹ and R.D. WELSH²

¹AgResearch, Ruakura Agricultural Centre, Private Bag 3123, Hamilton

²CIBA-GEIGY New Zealand Ltd, Christchurch

SUMMARY

Two field trials and one screenhouse pot trial were conducted using furathiocarb applied to brassica seed at 0.5 and 1.0% of seed weight. Terbufos applied at 0.6 or 0.72 kg/ha as in-furrow granules or thiodicarb applied at 1.95% of seed weight were included as standards. Furathiocarb and thiodicarb were equally effective in reducing garden springtail (*Bourletiella hortensis*) and lucerne flea (*Sminthurus viridis*) numbers and their damage on seedling kale (*Brassica oleracea acephala*). Springtail (*Bourletiella* spp.) feeding damage to rape (*B. napus oleifera*) and swedes (*B. napus rapifera*) was equally reduced by furathiocarb and terbufos. In these trials no adverse effect on brassica germination or early seedling growth was seen with the use of furathiocarb.

Keywords: springtails, brassicas, seedling damage, furathiocarb, seed treatment

INTRODUCTION

Insect damage during the germination and seedling stages can be responsible for poor establishment of brassica crops. Lowe (1956) reported on surveys which indicated about half of all brassica plantings suffered moderate to severe damage by insects, chiefly weevils (*Listronotus bonariensis* and *Irenimus* spp.), grass grub beetles (*Costelytra zealandica*) and springtails. Several species of springtail may cause damage to seedling brassica crops, but garden springtail (*Bourletiella hortensis*) is regarded as the most common. Studies by Cleland (1955) suggested that springtail numbers as low as 215/m² can cause significant damage to germinating brassicas.

Insecticides applied as seed treatments, granules at planting, or sprays at seedling emergence can control springtail populations and improve seedling establishment (Cleland 1955; French and Douglas 1967; Upritchard and Park 1976). Coating of forage brassica seed with an insecticide in combination with fungicides and nutrients is now common practice in New Zealand.

This paper reports on trials evaluating the systemic carbamate insecticide, furathiocarb, as a seed treatment for the protection of brassica seedlings from damage by springtails.

METHODS

Seed used in the trials was coated by International Seed Coaters, Palmerston North. All seed received fungicides and nutrients and, where appropriate, furathiocarb (Promet 400 CS). Thiodicarb (90% manufacturer's concentrate) was applied in combination with a gelatin sticker and inert absorbent to the outside of seed previously treated with the fungicides and nutrients.

Trial 1: Bioassay trial

For each treatment (Table 1) nine kale seeds (cv. 'Maris Kestral') were sown into each of four replicate 16 cm square pots containing sieved insect-free soil on 6 October 1993. The pots were placed in a screenhouse in a randomised block design.

Two days after planting 50 garden springtails and 20 lucerne flea were confined in each pot, equivalent to 2730 springtails/m². After a further 10 days, surviving springtails were collected, killed in 70% alcohol and counted under a binocular

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microscope. Seedlings were counted and removed from the pots. Springtail feeding scars on both surfaces of the cotyledons were counted under a binocular microscope.

Trials 2 and 3: Small plot trials.

Trial 2 was conducted at Springston, Canterbury, in January 1992 using a mixture of rape (cv. 'Emerald') and swede (cv. 'Doon Major') seed while Trial 3 was at Kaiwera, Southland, where swedes (cv. 'Doon Major') were sown in December 1992. The treatments (Table 2) were sown with a precision cone seeder at a sowing rate of 3 kg/ha. The terbufos granules (Counter 20G) were applied in the furrow at planting. The plots, 2.1 x 10 m, were replicated five (Trial 3) or six (Trial 2) times in a randomised block design.

For Trial 2 plant numbers in two 45 cm (4 rows) wide x 55 cm long quadrats and springtail feeding damage on 10 plants were recorded for each plot 21 days after sowing. For Trial 3 plant numbers in one 45 cm (4 rows) wide x 55 cm long quadrat and the number of springtail feeding scars on 10 plants were recorded for each plot 11 days after sowing. Springtail numbers in both trials were estimated by randomly placing five sticky traps (each 25 cm²) on the ground within each plot for a period of 10 minutes (Trial 3) or 2 hours (Trial 2). Trapping occurred 11 (Trial 3) or 21 (Trial 2) days after sowing.

The data from all trials were subjected to analyses of variance.

RESULTS

Trial 1

All insecticide seed treatments were equally effective in reducing garden springtail and lucerne flea numbers ($P < 0.001$) and their damage in the kale seedlings (Table 1). The seed treatments reduced both the number of feeding scars per pot ($P < 0.05$) and per seedling ($P < 0.001$) compared to untreated seed. Seedling establishment was enhanced by all insecticide seed treatments but the increases were only statistically significant for both rates of furathiocarb ($P < 0.05$) (Table 1).

TABLE 1: Springtail survival and seedling kale survival and damage in the presence of springtails as influenced by furathiocarb and thiodicarb seed treatments.

Treatment	Rate (g ai/kg seed)	No. springtails remaining		No. seedlings remaining 12 days after sowing	No. feeding scars	
		Garden springtail	Lucerne flea		per pot	per seedling
untreated	-	28.3	13.0	6.5	59.0	8.8
furathiocarb	5	7.3***	3.5***	8.5*	27.3*	3.3***
furathiocarb	10	9.8***	2.0***	8.3*	28.5*	3.4***
thiodicarb	19.5	9.0***	1.8***	8.0	21.8*	2.8***
LSD _(0.05)		6.9	3.9	1.7	24.9	2.6

*, *** significantly different from untreated at $P < 0.05$ and $P < 0.001$ respectively.

Trial 2

Seedling numbers 21 days after sowing were increased relative to untreated seed, only by the application of terbufos granules at planting ($P < 0.05$) (Table 2). The number of plants with springtail feeding damage was reduced by all insecticide treatments ($P < 0.01$). The number of springtails (*Bourletiella* spp.) caught on the sticky traps was unaffected by treatment.

Trial 3

Plant numbers 11 days after sowing were unaffected by insecticide treatment (Table 2). All insecticide treatments reduced the number of seedlings with springtail feeding damage although sticky trap catches indicated low but similar springtail (*Bourletiella* spp.) numbers in each treatment.

No visible phytotoxicity was evident in the seedlings in this trial or those in Trials 1 and 2.

TABLE 2: Survival and damage of brassica seedlings in the presence of springtails and springtail numbers caught by sticky traps as influenced by furathiocarb seed treatments and terbufos granules.

Treatment	Rate	Number of plants/m ²	% of plants with damage	Number of springtails caught/sticky trap
Trial 2 (assessed 21 days after sowing)				
untreated		27.5	16.1	22.6
furathiocarb	5 g ai/kg seed	36.7	10.9**	26.1
furathiocarb	10 g ai/kg seed	31.8	9.4**	22.8
terbufos	600 g ai/ha	50.9*	10.4**	19.8
LSD _(0.05)		21.8	2.6	6.8
Trial 3 (assessed 11 days after sowing)				
untreated		35.8	54.0	6.1
furathiocarb	5 g ai/kg seed	36.2	30.0*	7.7
furathiocarb	10 g ai/kg seed	28.0	22.0**	7.7
terbufos	720 g ai/ha	31.8	18.0**	7.0
LSD _(0.05)		13.3	21.0	1.9

*, ** significantly different from untreated at P<0.05 and P<0.01 respectively

DISCUSSION

Springtail populations in the pot trial caused substantial damage in the untreated kale seedlings resulting in the death of some plants. Damage, visually observed during the trial, was similar to that reported by Cleland (1955). Damage began as soon as the seed shell was shed and the cotyledons exposed. Stems supporting the cotyledons were often damaged before the cotyledons appeared above the ground. Cotyledon damage appeared first as slight scalloping on the leaf edge or as small pits or shot-holes in the leaf. Damage increased rapidly with some cotyledons completely destroyed. Furathiocarb applied at 0.5 and 1% of seed weight reduced seedling damage and enhanced seedling survival. This resulted from increased mortalities in garden springtail and lucerne flea populations of 65-84% relative to populations feeding on untreated seedlings. Both rates of furathiocarb effected similar mortalities to the standard seed treatment, thiodicarb. Greater reductions in springtail populations may have been achieved by the insecticide seed treatments if some form of weed control had been implemented. Volunteer weed seedlings emerging in the pots provided favourable alternative host plants with many being severely defoliated.

Seedling damage in the field trials appeared mainly as pits or shot-holes in the cotyledons. Feeding damage from other insect pests such as weevils was not evident. Both rates of furathiocarb seed treatment and terbufos granules were equally effective in reducing springtail feeding on the brassica seedlings.

In Trial 2, an increase in seedling numbers occurred with the application of terbufos granules. It is unlikely that the increase resulted from the control of springtails considering the low level of damage recorded in the untreated plots. Seedling numbers were highly variable within the plots and the increase may not have been a treatment effect. Alternatively, subterranean pests feeding on the seed or germinating seedlings and controlled by terbufos but not by furathiocarb may have been responsible.

The relatively low damage levels in the field trials indicated low springtail populations present in the plots. Assessment of springtail populations in field plots of brassica seedlings is difficult because the insects are difficult to see and highly mobile.

Coring, followed by extraction in tullgren funnels, has proven successful for quantifying lucerne flea populations in pasture (Dentener 1985) but is not practical in cultivated soil. The use of sticky traps to give estimates of springtail populations in the field trials was not successful. In both trials the traps caught similar numbers of springtails in each treatment with numbers caught not reflecting damage levels in the brassica seedlings.

Furathiocarb is now registered in New Zealand for use as a seed treatment for forage brassicas against springtails. The results of the present work support the claim that furathiocarb applied to brassica seed at 0.5 or 1% of seed weight is an effective protectant against springtails, with no apparent phytotoxicity.

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