Tests of Agrochemicals and Cultivars 11 (1990)
Ann. appl. Biol. 116 (Supplement)

Final Report

EVALUATION OF INSECTICIDES AGAINST LARGE NARCISSUS FLY

S.J. Jones, R.W. Brown, R.L. Gwynn, R.W. Rogers and C.J. Tavaré
ADAS Entomology Department, Staplake Mount, Starcross, Devon EX6 8PE

Keywords: narcissus, large narcissus fly, *Merodon equestris*, insecticide

Introduction

Since the 1950's, the large narcissus fly, *Merodon equestris*, has been controlled mainly by band-spraying with aldrin at planting. None of the alternative field treatments tested has been reliably effective.

Materials and Methods

On 18 September 1987, narcissus bulbs (cv Hollywood; size 9-11) were planted in 0.76 m-wide rows at a density of 20 bulbs/m at a site in Dorset. The trial consisted of four randomized blocks, each of forty plots; each plot comprised a single 2.5 m length of row. Three aldrin (30% e.c.; Aldrex 30; Shell) treatments (0.26, 0.46 and 0.66 g a.i./m) were applied, each in a 0.1 m-wide band over the exposed bulbs in the open furrows before ridging up. On 13 May, 10 June and 8 July 1988, the following insecticide treatments were applied: aldicarb (10% granules; Temik 10G; Union Carbide) at 0.077 g a.i./m, bendiocarb (3% granules; Garvox 3G; FBC) at 0.036 g a.i./m, carbofuran (5% granules; Yaltox; Bayer) at 0.125 g a.i./m, chlorfenvinphos (10% granules; Birlane Granules; Shell) at 0.07 g a.i./m, chlorpyrifos (48% e.c.; Dursban 4; Dow) at 0.205 g a.i./m, disulfoton (10% granules; Disyston P10; Bayer) at 0.108 g a.i./m, disulfoton and chlorpyrifos (6% + 4% combined granules; Twinspan; PBI) at 0.108 and 0.072 g a.i./m respectively, disulfoton and fonofos (6% + 4% combined granules; Doubledown; Stauffer) at 0.108 and 0.072 g a.i./m respectively, DPX 43898/4 (10% granules; Shell) at 0.1 g a.i./m, ethoprophos (10% granules; Mocap 10G; Hortichem) at 0.25 g a.i./m, fonofos (10% granules; Dyfonate 10G; Stauffer) at 0.07 g a.i./m, fonofos (48% microencapsulated; Dyfonate MS; Stauffer) at 0.292 g a.i./m, oxamyl (10% granules; Vydate 10G; DuPont) at 0.16 g a.i./m, phorate (10% granules; BASF Phorate; BASF) at 0.15 g a.i./m, and triazophos (42% e.c.; Hostathion; Hoechst) at 0.24 g a.i./m. Four untreated plots, four of the eight plots treated with each rate of aldrin, and all plots treated with other insecticides were harvested on 16 August 1988. All harvested bulbs (47 to 55 per plot) were sectioned and examined during September and October. On 7 September, new bulbs were planted into all harvested plots. Newly planted rows were aligned with the original rows, on the assumption that no insecticides used in 1988 were likely to persist in significant quantities until the following summer; secondarily, this enabled an evaluation of the residual effect of aldrin band applications at planting to be made. In 1989, the following insecticide treatments (the same product, and at the dose used in 1988, except where specified) were applied to plots left undisturbed since planting in 1987, and to plots replanted in 1988. Carbofuran, disulfoton, phorate, and vamidothion (40% e.c.; Kilval; May and Baker) at 0.043 g a.i./m, were applied on 20 June; chlorpyrifos and fonofos (microencapsulated) were applied on 1 June and 20 June; omethoate (50% e.c.; Folimat; Bayer) at 0.043 g a.i./m, and demeton-S-methyl (50% e.c.; Metasystox 55; Bayer) at 0.011 g a.i./m, were applied on 20 June and 10 July; cyromazine (2% soluble granules; Ciba-Geigy) at 0.05 g a.i./m, was applied on 30 June and 10 July; triazophos was applied on 1 June, 20 June and 10 July; and dimethoate (37% e.c.; Rogor E; FBC) at 0.024 g a.i./m, and trichlorphon (80% s.p.; Dipterex 80; Bayer UK Ltd) at 0.108 g a.i./m, were applied on 20 June, 30 June and 10 July. All postplanting insecticide treatments were 0.1 m-wide band-applications along the row centres. Granules were applied using hand-held (pepper-pot) dispensers. Sprays were applied using a hand-operated knapsack sprayer. The whole trial was harvested in early August. Two batches, each of roughly 340 untreated bulbs, one batch from

plots left undisturbed since planting in 1987 and the other from plots replanted in 1988, were immersed in trichlorphon (Dipterex 80; Bayer) at 50 g a.i./litre for 15 minutes. During October and November, all bulbs harvested (64 to 122 bulbs per plot from replanted plots; 48 to 106 bulbs per plot from the undisturbed plots) were sectioned and examined.

Results

Bulbs replanted into plots treated with aldrin the year before, incurred less damage than untreated bulbs, but more damage than the second-year bulbs in undisturbed, aldrin-treated plots. Soil-acting systemic insecticides gave better control of damage than did other insecticides (except aldrin) in both years, but in 1989 even the most effective systemic insecticides were effective only on second-year bulbs. Of the insecticides applied in both years, carbofuran and disulfoton were consistently the most effective. Neither of the disulfoton combined granule treatments reduced damage by any more than did disulfoton alone. Although applied only in 1989, demeton-S-methyl, dimethoate and vamidothion each reduced damage to roughly the same extent as did carbofuran and disulfoton in that year.

Table 1. Mean percentage of bulbs attacked by large narcissus fly larvae

Treatment≠			Date planted		
Insecticide formulation	Dose per year (g a.i./m)		1987	1988	1987
			Date assessed		
	1987/8	1989	1988	1989	1989
Aldrin 30% e.c.	0.26	-	11.1	2.1	0.7
Aldrin 30% e.c.	0.46	-	0.0	2.4	0.0
Aldrin 30% e.c.	0.66	-	0.0	9.9	1.4
Aldicarb 10% granules	0.23	-	1.5	-	-
Bendiocarb 3% granules	0.11	-	9.5	-	-
Carbofuran 5% granules	0.38	0.13	5.0	9.0	1.6
Chlorpyrifos 40% e.c.	0.62	0.41	29.6	13.5	4.2
Demeton-S-methyl 50% e.c.	-	0.02	-	11.8	6.1
Dimethoate 37% e.c.	-	0.07	-	8.6	2.4
Disulfoton 10% granules	0.32	0.11	4.8	7.7	2.4
Oxamyl 10% granules	0.48	-	5.4	-	-
Phorate 10% granules	0.45	0.15	8.2	16.3	9.6
Vamidothion 40% e.c.	-	0.04	-	10.7	4.7
Untreated	-	-	27.7	12.5	12.7
LSD (p = 0.05)			10.20	11.50	5.86

≠ Treatments not included gave no significant reduction in damage.

Discussion

Replanting bulbs into land previously treated with aldrin may give some residual protection against large narcissus fly attack, but the risk of misaligning the bulb rows and aldrin bands, and the probability that cultivations would grossly dilute any aldrin present, make the outcome unpredictable. Carbofuran and disulfoton have given consistently better control than all other recommendable insecticides used in recent trials. However, the ineffectiveness of a single application of either insecticide on first-year bulbs in 1989 suggests that higher rates, or more than one application, may be needed in some crops. Demeton-S-methyl, dimethoate and vamidothion warrant further evaluation.

Acknowledgements

This work was funded by the Horticultural Development Council.

Tests of Agrochemicals and Cultivars 11 (1990)
Ann. appl. Biol. 116 (Supplement)

TOLERANCE OF NARCISSUS CULTIVARS TO BULB-IMMERSION TREATMENTS WITH CHLORPYRIFOS

S.J. Tones
ADAS Entomology Department, Staplake Mount, Starcross, Devon EX6 8PE
A.A. Tompsett
Rosewarne Experimental Horticulture Station, Camborne, Cornwall TR14 0AB

Keywords: chlorpyrifos, cultivars, hot water treatment, large narcissus fly, Merodon equestris, narcissus, tolerance

Introduction

Since the 1950s, chemical control of the large narcissus fly, Merodon equestris, has been achieved exclusively by the use of aldrin. Saynor (unpublished) found that chlorpyrifos, either added to the hot water treatment solution, or applied as a cold dip after hot water treatment, prevented damage by the pest in the first year of cropping, but gave no control in the second year. This paper describes an experiment done to assess the phytotoxic effect of immersing narcissus bulbs in chlorpyrifos before planting.

Materials and Methods

At Rosewarne Experimental Horticulture Station near Camborne in Cornwall, bulbs of the cultivars Carlton, Cheerfulness, Golden Harvest, June Allyson, Lady Serena, and White Lion, were either stored at ambient temperature or were pre-warmed at 30°C for 7 days before hot water treatment. All ambient-stored bulbs were hot water treated at 44.4°C for 3 hours. All pre-warmed bulbs were pre-soaked in cold water for 3 hours, and then hot water treated at 46°C for 3 hours. Chlorpyrifos (48% e.c.; Spannit; Pan Britannica Industries) was either incorporated at 2.4 g a.i./litre in the hot water treatment solution, or applied at 4.8 g a.i./litre as a 15-minute cold dip 2 hours after hot water treatment. The bulbs were dried, then planted 2 days later on 19 August 1988. The trial was of split-plot design, with three replicates. Sub-plots consisted of a single 2.5 m length of row, each of which was planted with 50 bulbs; the weight of planted bulbs averaged roughly 25 kg per sub-plot. Flower yield and quality were assessed at picking during February and March, and all bulbs in each plot were lifted and weighed on 12 July 1989.

Results

Hot water treatment with chlorpyrifos reduced the marketable flower yield of ambient-stored bulbs of all cultivars except Carlton, but had no effect on the flower production of pre-warmed bulbs (Table 1). Flower production of all varieties except White Lion was unaffected by cold dipping in chlorpyrifos after hot water treatment. Hot water treatment with chlorpyrifos reduced the bulb weight increase of ambient-stored bulbs of all cultivars, including Carlton, but had no effect on the weight increase of pre-warmed bulbs (Table 2). Bulb yield was unaffected by cold dipping in chlorpyrifos after hot water treatment.

Table 1. Numbers of marketable flowers (Class 1 and 2) per kg bulbs planted

Treatments		Cultivars					
Storage	Chlorpyrifos	Carlton	Cheer-fulness	Golden Harvest	June Allyson	Lady Serena	White Lion
Ambient	Untreated	19.6	7.2	8.3	10.1	21.2	18.3
Pre-warmed	Untreated	16.2	27.5	18.6	25.8	3.8	23.3
Ambient	Cold dip	19.5	7.0	8.0	8.7	19.5	12.0
Pre-warmed	cold dip	21.4	28.7	19.2	36.6	24.5	23.7
Ambient	In HWT	15.6	1.1	2.0	2.8	9.9	4.5
Pre-warmed	In HWT	20.5	26.0	16.9	27.2	23.0	26.5

LSD ($p = 0.05$) 2.78 for all within-variety comparisons

Table 2. Percentage increase in bulb weight after 1 year

Treatments		Cultivars					
Storage	Chlorpyrifos	Carlton	Cheer-fulness	Golden Harvest	June Allyson	Lady Serena	White Lion
Ambient	Untreated	70	54	66	64	44	65
Pre-warmed	Untreated	86	51	59	66	52	71
Ambient	Cold dip	66	49	61	63	36	66
Pre-warmed	Cold dip	88	61	65	66	50	63
Ambient	In HWT	50	18	28	46	15	47
Pre-warmed	In HWT	74	61	60	56	51	65

LSD ($p = 0.05$) 10.8 for all within-variety comparisons

Discussion

The results suggest that cold dipping of bulbs in chlorpyrifos after hot water treatment is unlikely to suppress the production of flowers or bulbs of most narcissus cultivars, and that pre-warmed bulbs could be hot water treated with chlorpyrifos instead of cold dipping. Applying chlorpyrifos during hot water treatment would obviate the need for an extra treatment process, but would create a larger volume of the dilute pesticide for disposal. Although some cultivars, such as Carlton, may be relatively tolerant to hot water treatment with chlorpyrifos after ambient storage of the bulbs, flower production, or bulb yield, or both, seem likely to be reduced to some extent by treatment. Cultivar tolerance to chlorpyrifos may depend on the size, conformation, and developmental stage of the treated bulbs, and may therefore differ from crop to crop and from year to year. The losses incurred in commercial bulb production would be smaller than those observed in the first year of this trial if compensation occurs in the second year of growth.

Acknowledgements

This trial was funded by the Horticultural Development Council. We thank the former staff of Rosewarne EHS who did most of the practical work.