CONTROL OF CHICKWEED *(DRYMARIA CORDATA)* IN DECLINING TROPICAL PASTURES.

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ABSTRACT

On the Atherton Tableland, tropical chickweed (Drymaria cordata) *is an increasing problem in irrigated pastures. Preliminary screening of herbicides showed (±)-2-(2,4,5-trichlorophenoxy) propionic acid (fenoprop) as the most effective chemical for its control.*

*Satisfactory control was achieved with 1.68-2.24 kg ae ha^{-1} of fenoprop as either the propylene glycol ether ester or the butyl ester with 0.1% nonionic wetting agent. Raking off deam material after spraying had no effect. Glycine (*Glycine wightii*) was severely damaged by fenoprop.*

Cultivation and fenoprop were equally effective in controlling chickweed. Under non-irrigated conditions chickweed was observed to be satisfactorily controlled by the spring dry season.

INTRODUCTION

Tropical chickweed (*Drymaria cordata*) has appeared as a problem in some of the irrigated, nitrogen fertilized pastures on the Atherton Tableland. Rapid spread of chickweed occurs in pastures which have been denuded by overgrazing or by pasture webworm attack (Elder 1965). Under these conditions the chickweed is able to perennate.

Chickweed sends out runners which root at the nodes quickly establishing a dense cover impenetrable to young grass and legume seedlings. Consequently, once chickweed is established, careful grazing under continual irrigation does little or nothing to alleviate the problem.

Chemical control

The herbicides 2'-chloro-2, 6'-diethyl-N-methoxymethyl *O*-acetanilide (alachlor) and 6'-*tert*-butyl-2 chloro-N-(methoxymethyl)-*O*-acetotoluidide (CP44939) applied pre-emergence only gave short term control of *Drymaria cordata* (Tropical Pesticides Research Institute 1969-70). Fryer and Makepeace (1970) indicated the resistance of *Stellaria media* (a species related to *Drymaria*) to 2,4-dichlorophenoxyacetic acid (2,4-D) and 4-chloro-2-methylphenoxyacetic acid (MCPA) but susceptibility to (±) -2-(2,4-dichlorophenoxy) propionic acid (dichlorprop) and (±)-2-(4-chloro-2-methylphenoxy) propionic acid (mecoprop).

Preliminary observations of logarithmic strips of 2,4-D (as the amine salt) with 2.5% or 0.1% nonionic wetter, 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) (as the butyl ester) with 0.1% nonionic wetter, mecoprop (as the mixed di-isomers of the potassium salt) with 2.5% or 0.1% nonionic wetter and (±)-2-(2,4,5-trichlorophenoxy) propionic acid (fenoprop) (as the propylene glycol ether ester (PGEE)) with 0.1% nonionic wetter showed that fenoprop gave the most effective control of chickweed (authors' unpublished data). Indications were that satisfactory control could be obtained at the rate of 1.68 kg ae ha^{-1}.

The aim of the first two experiments described here was to determine whether fenoprop as the cheaper butyl ester (BE) was as effective as the propylene glycol ether ester (PGEE) in controlling chickweed and to determine the optimum rate of application. To determine whether the pasture species recovered more quickly if the dead chickweed was removed, raked and unraked treatments were included. The third experiment was designed to investigate any interaction of nitrogen and basal fertilizers with methods of weed control.

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MATERIALS AND METHODS

In all experiments the equipment used for the application of chemicals was an Oxford Precision Sprayer with a 140 cm boom delivering a spray swath of 175 cm. The spray volume was 337 l ha^{-1} applied at 206.8 kPa. The nozzles were flat fan (Tee Jet 730308). A nonionic wetting agent was added to all sprays at 0.1%.

The percentage cover of the chickweed and legume components of the pasture was assessed by three observers before spraying and at intervals afterwards. Five cover classes were recognised for the chickweed (0-20, 20-40, 40-60, 60-80, 80-100%) and six for the legume (0, 0-2, 2-4, 4-6, 6-8, 8-10%). The arc sine transformation was used for statistical analysis of the cover percentages.

Experiment 1

This experiment was laid down on October 6, 1972 on an irrigated paddock of Tinaroo glycine (*Glycine wightii* cv. Tinaroo)/green panic (*Panicum maximum* var. *trichoglume* cv. Petrie). The paddock (including experimental area) received regular weekly irrigations of 38 mm and ammonium nitrate was applied each month at 125 kg ha^{-1}. Phosphorus (188 kg P ha^{-1}) and potassium (100 kg K ha^{-1}) had last been applied in 1966 prior to a potato crop. The experiment was slashed or grazed as required to maintain a pasture height of 15-23 cm. The design was an 8 x 4 randomised block with a plot size of 1.83 m x 10.06 m.

The treatments were:

(i) Weedy check
(ii) Fenoprop (PGEE) at 1.68 kg ae ha^{-1} — dead chickweed raked off plot
(iii) Fenoprop (BE) at 1.12 kg ae ha^{-1}
(iv) Fenoprop (BE) at 1.12 kg ae ha^{-1} — dead chickweed raked off plot
(v) Fenoprop (BE) at 1.68 kg ae ha^{-1}
(vi) Fenoprop (BE) at 1.68 kg ae ha^{-1} — dead chickweed raked off plot
(vii) Fenoprop (BE) at 2.24 kg ae ha^{-1}
(viii) Fenoprop (BE) at 2.24 kg ae ha^{-1} — dead chickweed raked off plot

The chickweed was moist and in flower at the time of spraying. Treatments (ii), (iv), (vi), and (viii) were raked by hand 32 days after spraying. Assessments of the percentage cover were made just prior to spraying and 53 and 148 days after spraying.

Experiment 2

This experiment was laid down on July 18, 1973, on a heavily overgrazed paddock of glycine (*Glycine wightii* cv. Malawi)/Gatton panic (*Panicum maximum* cv. Gatton). The paddock (including the experimental area) received one irrigation 9 days after spraying and a few light showers of rain. The chickweed was in flower at the time of spraying. The treatments and design were as for Experiment 1 except that treatments (ii), (iv), (vi) and (viii) were not raked. Assessments were made prior to and 44 and 82 days after spraying.

Experiment 3

This experiment was laid down adjacent to Experiment 1 and was run concurrently with it. The design was a 3 x 2 x 2 factorial with four replicates laid out as randomised blocks. The plot size was 1.83 m x 5.49 m.

The treatments were:

1. Weed Control — nil, fenoprop spray, cultivation and replanting.
2. Basal fertilizer — nil, 125 kg ha^{-1} potassium chloride and 500 kg ha^{-1} Mo_{12} superphosphate.
3. Nitrogen fertilizer — nil, 250 kg ha^{-1} ammonium nitrate.

TABLE 1

The mean percentage of chickweed and glycine cover in Experiments 1 and 2 at indicated days after spraying

Treatment	Experiment 1				Experiment 2			
	Chickweed			Glycine	Chickweed			Glycine
Days from spraying	0	53	148	148	0	44	82	44
				% cover				
Weedy check	65 (54.59 a)**	60 (50.90 a)**	60 (50.90 a)**	1.50	80 (64.18 a)**	65 (53.84 a)**	55 (47.95 a)**	4.00
Fenoprop (BE) 1.12 kg/ha	65 (55.33 a)	10 (18.44 b)	40 (38.36 ab)	0.25	60 (50.90 a)	20 (25.83 cd)	15 (22.13 b)	1.00
Fenoprop (BE) 1.12 kg/ha – raked*	50 (45.00 a)	10 (18.44 b)	25 (28.77 bc)	0.50	75 (61.23 a)	35 (36.12 b)	15 (22.13 b)	1.50
Fenoprop (BE) 1.68 kg/ha	75 (61.97 a)	10 (18.44 b)	30 (32.47 bc)	0.25	80 (64.18 a)	25 (29.52 bc)	10 (18.44 b)	0.50
Fenoprop (BE) 1.68 kg/ha – raked*	55 (47.95 a)	10 (18.44 b)	20 (25.83 bc)	0.25	55 (44.26 a)	20 (25.83 cd)	10 (18.44 b)	0.75
Fenoprop (PGEE) 1.68 kg/ha – raked*	60 (51.64 a)	10 (18.44 b)	30 (31.72 bc)	0.25	70 (57.54 a)	15 (22.13 cd)	10 (18.44 b)	0.50
Fenoprop (BE) 2.24 kg/ha	55 (48.69 a)	10 (18.44 b)	20 (25.08 bc)	0.50	65 (54.59 a)	15 (22.13 cd)	10 (18.44 b)	0.50
Fenoprop (BE) 2.24 kg/ha – raked*	40 (38.36 a)	10 (18.44 b)	10 (18.44 c)	0.50	50 (44.26 a)	10 (18.44 d)	10 (18.44 b)	0.50
Assessment Means	58 (50.44)	16 (22.50)	19 (31.45)		67 (55.14)	24 (29.23)	17 (23.05)	

* Dead chickweed raked off in Experiment 1 only.

** Figures in parenthesis are the mean arc sine transforms. Means within columns followed by the same letter are not significantly different at the 5% level (Duncan's New Multiple Range Test).

LSD P = 0.05 for comparing assessment means in Experiment 1 = 5.62

LSD P = 0.05 for comparing assessment means in Experiment 2 = 4.05

Cultivation consisted of one ripping with tines to a depth of 10 to 13 cm followed by two passes of a rotary hoe. Plots were cultivated 26 days after the commencement of the experiment and replanted 5 days later with Gatton panic at 3.36 kg ha^{-1} and inoculated Tinaroo glycine at 4.48 kg ha^{-1}. Fenoprop was sprayed on at 1.68 kg ae ha^{-1} at the commencement of the experiment and again 73 days later. The trial was slashed to a height of 8 to 10 cm prior to the second spraying and the cut material removed by hand. Fertilizers were applied 12 days after the commencement of the experiment.

RESULTS

Experiments 1 and 2

There were no significant differences in chickweed cover prior to spraying in either experiment (Table 1), but all rates of fenoprop significantly reduced chickweed cover. At the time of the first assessment the lower rates of fenoprop were less effective in experiment 2 than in experiment 1. In experiment 1 chickweed regrew so that at 148 days after spraying it provided a greater cover than at 53 days after spraying. However, cover was still less than at spraying. In experiment 2 chickweed cover tended to decline with time on all the sprayed treatments.

At the application rate of 1.68 kg ae ha^{-1} the cheaper butyl ester of fenoprop was as effective as the propylene glycol ether ester. Fenoprop was extremely toxic to glycine.

Experiment 3

There were no significant differences in chickweed cover prior to treatment (Table 2). Cultivation and fenoprop both produced significant reductions in chickweed cover ($P<0.001$) and with each of these treatments basal and nitrogen fertilizers, separately or in combination, had no effect on chickweed cover. However, in the absence of fenoprop or cultivation, nitrogen fertilizer favoured the chickweed more than a combination of nitrogen and basal fertilizers.

TABLE 2

The mean percentage cover of chickweed and glycine in experiment 3, before and 148 days after the initial spraying

Treatment	% cover — *Before Treatment*	*After Treatment*	
	Chickweed	Chickweed	Glycine
Cultivation + basal + nitrogen	75 (61.23 a)*	10 (18.44 a)*	0.75
Cultivation + basal	85 (67.87 a)	10 (18.44 a)	2.00
Cultivation + nitrogen	80 (64.18 a)	10 (18.44 a)	0.75
Fenoprop + basal + nitrogen	65 (54.59 a)	10 (18.44 a)	0.50
Fenoprop + basal	50 (45.00 a)	10 (18.44 a)	0.50
Fenoprop + nitrogen	55 (48.69 a)	10 (18.44 a)	0.75
Cultivation	60 (51.64 a)	10 (18.44 a)	2.00
Fenoprop	70 (58.28 a)	15 (22.13 a)	0.50
Basal + nitrogen	50 (45.00 a)	45 (42.05 b)	2.25
Basal	70 (57.54 a)	65 (53.84 bc)	1.75
Nil	45 (42.80 a)	65 (55.33 bc)	3.00
Nitrogen	45 (42.05 a)	80 (64.18 c)	2.50
Assessment means	62 (53.24)	28 (30.55)	

* Figures in parenthesis are the mean arc sine transforms.

Means within columns followed by the same letter are not significantly different at the 5% level (Duncan's New Multiple Range Test).

LSD (P = 0.05) for comparing assessment means = 15.44

DISCUSSION

Table 1 shows an increase in chickweed cover, for all treatments, between the second and third assessments for Experiment 1 and a decrease in cover between the second and third assessments for Experiment 2. The increase in chickweed cover in Experiment 1 may be explained by the regular nitrogen applications and irrigations the trial received favouring the chickweed. The pasture species were unable to re-colonize bare patches saitsfactorily after fenoprop treatment, probably due to the lack of phosphorus and potassium (the pasture had received neither for six years). The reduction in chickweed cover in Experiment 2 was thought to be caused by the dry weather and the lack of irrigation.

It was noticed that the long dry spell experienced at the end of 1972 and extending into early 1973 was very damaging to the chickweed in non-irrigated paddocks so that all the established plants died and new growth, when the rains came in February, was entirely from seedlings. This factor gave the pasture species a tremendous advantage such that with proper management (i.e. grazing to maintain a minimum pasture height of 15 to 23 cm) the pasture species themselves were able to control the chickweed by shading.

It is suggested that the best method of preventing chickweed ingress is by pasture management, including the use of correct maintenance fertilizers to maintain vigorous growth of the pasture species. If the pasture is not denuded chickweed is unlikely to become a problem. When control measures do become necessary the best method may be by the rotation of irrigation paddocks (i.e. to drop the infested paddock out of irrigation for a year). A normal spring dry season should then kill all the established chickweed. When the rains come the pasture should be allowed to re-establish itself to a complete cover before grazing and thereafter should be managed to maintain this cover.

Where chickweed becomes a problem in pure grass pasture, the butyl ester of fenoprop may be used at 1.68 to 2.24 ae ha^{-1} as a control measure in conjunction with good grazing management. More than one spraying may be necessary depending on the rate of recolonisation by the pasture species. Fenoprop is more effective if applied under good growing conditions (cf. first assessments in experiments 1 and 2). However, after spraying in irrigated pastures receiving nitrogen, basal fertilizer must be used to give the pasture an advantage over re-invading chickweed. Fenoprop is too damaging to glycine for use as an overall spray in pastures containing this legume. As a last resort the paddock may be cultivated and replanted. Thorough cultivation under dry conditions will give satisfactory control of chickweed.

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