SELECTIVE APPLICATION OF GLYPHOSATE TO ERECT WEEDS IN PASTURES USING WEED WIPERS

D.J. CAMPBELL, R.G. FULTON, I.M. RUZIC and A.J. SOMERVAILLE

Monsanto Australia Limited
P.O. Box 4077
Melbourne Vic. 3001

Summary. Weed wiper (ropewick) application of a 12% w/v solution of glyphosate to erect weeds in pasture gave almost total control of rushes (*Juncus* spp.) and a 79 to 100% reduction of bracken (*Pteridium aquilinum* auct.) regrowth. Rush control was maximised by treatment of actively growing rushes in spring and summer. Bracken frond regrowth reduction was maximized by a double pass of a ropewick applicator in May to June.

INTRODUCTION

Weed wiper equipment has been developed to apply non-selective herbicides, such as glyphosate, in a selective manner. Selectivity is determined by the height differential between the target and crop or pasture species. The most common forms of weed wipers currently in use in Australia are ropewick applicators.

Ropewick applicators do not utilize pumps or moving parts; application occurs by rubbing the weed with absorbent ropewicks containing the herbicide solution (Dale 1979a). The solution of glyphosate contacts a smaller surface area of the target plant than by conventional spray methods. Evidence suggests that retention of glyphosate is greater from concentrated solutions (Reimer 1973; Upchurch *et al.* 1972).

Equipment design varies from a simple shoelace or pipewick arrangement where numerous ropewicks extend laterally in sections along the exterior of a cylindrical PVC tank, to a multirope design where a number of suspended ropewicks form the steps of a horizontal ladder between gravity fed manifolds. When applied by ropewick, glyphosate efficacy is largely dependent on solution viscosity (Dale 1979b), the physical characteristics of the ropewick material, the applicator design and factors which determine the rate of herbicide removal from the ropewicks by the wiping action (Derting 1981).

MATERIALS AND METHODS

Field trials were established with both pipewick and multirope equipment throughout southern Australia in 1980 to investigate the control of weeds primarily in pastures. Equipment was either mounted on bicycle wheeled frames or on rigid frames attached to tractor three point linkages. All equipment was height adjustable to allow selective contact with target species above desirable pasture species.

Glyphosate was applied to two major weeds of pasture, rushes (four species) and bracken. All treatments were with a 12% w/v glyphosate solution which has been found by Dale (1979b) to give the most acceptable flow rate characteristics. Speeds of 4 to 8 km hr^{-1} were used with both single and double passes (in opposite directions) across the target foliage.

Trial design varied with the size and nature of the weed infestations with plot size varying from 100 to 280 m^2 with 2 or 3 replications. Ground cover varied from 20 to 90% for rushes and 70 to 100% for bracken. Trials were assessed by an injury rating which took account of phytotoxicity (chlorosis etc.) stand reduction, and where applicable regrowth.

RESULTS

Bracken. Application of 12% w/v glyphosate by ropewick applicator in New South Wales, South Australia and Victoria resulted in 40 to 67% injury to bracken 23 to 30 days after treatment, with double passes resulting in better control (Table 1). By 120 to 257 days after treatment there was 79 to 100% injury with double passes still giving better control.

Table 1. Effect of ropewick application of 12% w/v glyphosate on bracken.

Bracken growth stage	Location and application date in 1980	Wick height (cm)	Speed (km hr^{-1})	No. of passes	Injury rating (%) (Days after treatment)	
Fronds unfurled 20 to 50 cm tall	Seymour Vic. May 19	15	5	1	80 (120)	79 (257)[1]
Fronds unfurled 20 to 60 cm tall	Moss Vale N.S.W. May 26	15	4	2	85 (150)[1]	
Fronds unfurled 20 to 60 cm tall	Mt. Gambier S.A. June 25	15	4	2	40 (23)	99 (127)[1]
		30	4	1	40 (23)	88 (127)[1]
		30	4	2	55 (23)	100 (127)[1]
Fronds mature 15 to 45 cm tall	Adelaide Hills S.A. October 10	30	4	1	57 (28)	
		30	4	2	67 (28)	
80% Fronds unfurled 10 to 40 cm tall	Moss Vale N.S.W. October 26	15	4	1	63 (30)	

[1] Regrowth reduction.

The degree of long term bracken control achieved by the application of a translocated herbicide depends on the timing of application due to its phasic growth cycle as described by O'Brien (1963). Application in May and June resulted in 79 to 100% reduction in new frond growth four to eight months after treatment. Control due to a double pass was better than that of a single pass and similarly application at 30 cm height resulted in greater control than at 15 cm height.

Rushes. Complete phytotoxicity on rushes was evident not only by brownout of the green stems (Table 2) but also by discoloration and breakdown of the rootstock and a weakening at the base of the stems allowing easy removal. Treatment of drought stressed spiny rush in New South Wales in September did not result in complete control with either single or double passes whereas October and November applications to actively growing spiny rush in South Australia did

Table 2. Effect of ropewick application of 12% w/v glyphosate on four rush species.

Rush species and location	Treatment date in 1980	Rush height (cm)	Wick height (cm)	Speed (km hr^{-1})	No. of passes	Injury rating (%) (Days after treatment)
Spiny rush (*Juncus acutus*)						
Rawsonville, N.S.W.	Sept. 30[1]	20 to 80	20	5	1	60 (30)
			20	5	2	70 (30)
			20	8	1	50 (30)
			20	8	2	80 (30)
Mypolonga, S.A.	Oct. 24	40 to 60	45	4	1	100 (35)
			45	4	2	100 (35)
Yankalilla, S.A.	Oct. 28	60 to 120	45	4	1	90 (27) 100 (78)
			45	4	2	100 (27) 100 (78)
Mt. Compass, S.A.	Nov. 11	40 to 60	45	4	1	90 (34) 95 (65)
			45	4	2	100 (34) 100 (65)
Loose-flowered rush (*Juncus pauciflorus*)						
Harvey, W.A.	Oct. 7	30 to 40	15 to 20	8	2	80 (16) 100 (40)
Waroona, W.A.	Nov. 11	30 to 40	15 to 20	6	1	66 (20) 73 (30) 81 (60)
				6	2	87 (20) 95 (30) 98 (60)
Common rush (*Juncus usitatus*)						
Harvey, W.A.	May 8	30 to 60	15 to 20	4	1	50 (30) 75 (60) 80 (150)[2]
				6	1	60 (30) 78 (60) 80 (150)[2]
				8	2	70 (30) 90 (60) 98 (150)[2]
Numurkah, Vic.		50 to 100	30	5	1	83 (30) 85 (61)
						87 (30) 98 (61)
Pale rush (*Juncus pallidus*)						
Yankalilla, S.A.	Oct. 28	60	45	4	1	50 (23) 95 (78)
		120	45	4	2	60 (27) 100 (78)

[1] Drought stressed at time of treatment.

[2] Following slashing 90 days after treatment.

produce complete control. Similarly growth of common rush in May in Western Australia was sub-optimal resulting in slower injury and a better result for the double pass. Speed of travel (4 to 8 km hr^{-1}) did not appear to affect phytotoxicity.

DISCUSSION

The dosage required to kill frond buds on the rhizome of bracken appears to necessitate double passes of a ropewick applicator. Superior control with a 30 cm height setting may indicate greater absorption of glyphosate by the underside of bracken fronds at this height compared to that achieved at 15 cm, where more contact with stems may be expected. Applications to bracken in October 1980 gave short term phytotoxicity, but assessment of frond regeneration six to eight months after treatment (mid-1981) will be necessary.

Differences between the rush species in plant and rootstock size possibly account for the differential responses with time. Rushes were observed to vary in growth with maximum growth occuring in spring and summer when the majority were treated. All rush species are summer flowering (Black 1922). Slashing has been used on trials on both bracken and rushes to aid assessment of the longevity of control.

Application of glyphosate by weed wiper equipment may result in relatively low rates of herbicide applied per hectare since the effective rate is largely determined by the density of infestation treated. Estimates of glyphosate applied to rushes varied from 0.36 to 1.44 kg ha^{-1} for ground cover of 20 to 90% respectively. Estimates of glyphosate applied to bracken varied more due to variations in frond size and density with application rates of 1.08 to 3.24 kg ha^{-1}. The major benefit in this method of treatment however is in the selectivity obtained by height in that pasture growth is not affected by treatment.

Limited data from trials not reported here indicate that glyphosate applied by ropewick applicator successfully controls both annual and perennial weeds such as variegated thistle (*Silybum marianum*) and cape tulip (*Homeria* spp.).

The investigation of glyphosate applied by ropewick applicator for the control of other erect weeds in pastures and crops is continuing.

LITERATURE CITED

Black, J.M. 1922. Flora of South Australia. Rev. and ed. J.P. Jessop, 3rd ed., Government Printer, S.A., 1978, p. 332-329.

Dale, J.E. 1979a. Pans 25: 431-436.

Dale, J.E. 1979b. Proc. Beltwide Cotton Production Conf. - 3rd Cotton Weed Sci. Res. Conf., Phoenix, Ariz. p. 138-141.

Derting, C.W. 1981. Correlation of ropewick design and components with glyphosate performance. Proc. So. Weed Sci. Soc. 34: in press.

O'Brien, T.P. 1963. Ann. Bot. N.S. 27: 253-267.

Reimer, D.N. 1973. Proc. N.E. Weed Sci. Soc. 27: 101-104.

Upchurch, R.P., D.D. Baird and G.F. Begeman. 1972. Proc. Weed. Sci. Soc. Amer. p. 80.