Herbicides evaluated for tropical perennial grasses

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Abstract: *Successful establishment of sown pastures is often threatened by weed competition in the seedling stage. While a range of herbicides are registered for weed control in grass-only pastures, many of these have not been evaluated on sown tropical perennial grasses and the range of summer growing weeds that compete with them at establishment. This paper reports the evaluation of 20 post-emergent herbicides and mixtures at Loomberah near Tamworth, and incorporates the results from earlier work undertaken at Narrabri. The data contributed to the successful application, by the Grassland Society of NSW, for a pesticide permit to use a broader range of herbicides for weed control on tropical perennial grasses. Producers now have greater flexibility for herbicide options to control a broader weed spectrum at pasture establishment.*

Keywords: secondary root system, pre-emergent, post-emergent, phytotoxicity, herbicide, weed control.

Introduction

Initial herbicide studies in New South Wales (NSW) for weed control in tropical perennial grasses were conducted near Narrabri and commenced in 1998 (McMillan and Cook 1989, McMillan *et al.* 1992). These studies involved two pre-emergent and two post-emergent herbicide experiments investigating the effects of a broad range of generic herbicides. Although the work focused mainly on grasses such as Bambatsi panic (*Panicum coloratum*), purple pigeon grass (*Setaria incrassata*) and Curly Mitchell grass (*Astrebla* spp.), it was expected that the research would be applicable to other grasses such as Rhodes (*Chloris gayana*) and digit (*Digitaria eriantha*).

It was concluded from the pre-emergent herbicide studies that these herbicides were generally too damaging (high phototoxicity) to pasture grass species and resulted in highly variable weed control. Of those evaluated, metsulfuron and triasulfuron, were considered to be the options least likely to cause unacceptable damage to tropical perennial grasses, however they were registered for pre-emergent control of many grass weed species and the level of weed control obtained in the study was insufficient to risk potential damage to the grass pastures.

In contrast, the post-emergent herbicides produced lower and more consistent phytotoxicity ratings and had acceptable weed control. However herbicides such a MCPA, 2,4-D amine and metsulfuron-methyl had the potential to cause moderate damage if applied to pasture grasses at growth stages less than 2–3-leaf stage. As the sown plants mature their level of tolerance increases rapidly such that applications of herbicides to pasture grasses at the early tillering stage often cause only slight and transient damage.

With the continued establishment of tropical perennial grasses across the North-West Slopes and Plains and now south into the Central-West Slopes and Plains, and east onto the northern Tablelands, knowledge on the effectiveness of a greater range of herbicides is required and their use registered to provide producers with greater flexibility for weed control.

The need for pre-emergent weed control can be managed mostly in the planning stage. Annual summer grass weeds are the biggest weed threat to establishing tropical perennial grass pastures and can be successfully controlled by preventing seed set for up to two years prior to establishing the tropical perennial grasses (Lodge *et al.* 2010). However there is an increasing need for more knowledge on post-emergent broadleaf weed control and registration of those herbicides suitable for tropical perennial grasses. This paper describes a study that evaluated a range of herbicides and lists the nine herbicides and mixtures that have approved use in NSW as a result of this and previous studies.

Methods

An experimental site was selected at Loomberah, NSW in a newly sown commercial tropical grass pasture containing a mixture of Premier digit and Katambora Rhodes grass with a plant population ranging from 8–15 plants/m^2. The soil was a red Chromosol with soil pH 5.6.

Sixteen herbicides were chosen and with mixtures of these herbicides there were 20 herbicide treatments and a control (nil treatment, Table 1). The experiment was a randomised complete block design with three replicates. Herbicide treatments were applied on 24 January 2008 to plots 3 x 5 m when pasture grasses were between the three-leaf and mid-tillering stages. Each herbicide was applied with a hand-held boom with LD 110-01 nozzles and water volume of 100 L/ha. Weather conditions were fine with temperature during application ranging 29–32°C, humidity 47% and a light breeze (0.2–0.3 km/hr).

Weed population varied from 20–35 plants/m^2 and the main weed species were pigweed (*Portulaca oleracea*) and caltrop or yellow vine (*Tribulus terrestris*). Other species in low numbers included Patterson's curse (*Echium plantagineum*), turnip weed (*Raphanus raphanistrum*), deadnettle (*Lamium amplexicaule*), nightshade (*Solanum nigrum*), camel melon (*Cucumis myriocarpus*), paddy melon (*Citrillus lanatus*), cut-leaf mignonette (*Reseda lutea*) and tarvine (*Boerhavia dominii*).

Visual assessment of the pasture biomass reduction (%), and herbicide efficacy (%) compared with the control were conducted 15, 26 and 40 days after treatment (DAT). Pasture biomass (kg DM/ha) cuts (4 quadrats per plot, each 0.5 x 0.5 m, cut to 10 mm above ground level and dried for 48 h at 80°C) were also taken 40 DAT.

Results and Discussion

Most herbicides caused some phytotoxicity and pasture biomass reduction, compared to the control treatment. At 15 DAT 2,4-D amine 625 g/L + triclopyr 600 g/L, metsulfuron-methyl 600 g/kg + MCPA LVE 500 g/L, bentazone 480 g/L, clopyralid 300 g/L, fluroxypyr 200 g/L and metosulam 100 g/L resulted in over 20% reduction in tropical perennial grass biomass which exceeded the industry acceptable standard (Table 1). By 26 DAT, the tropical grasses had outgrown the herbicide damage with all treatments having less than 16% reduction in pasture biomass, with the exception of chlorsulfuron 750 g/kg which caused a 23% reduction in biomass (Table 1).

Only chlorsulfuron 750 g/kg continued to significantly reduce sown pasture biomass 40 DAT. Pasture biomass cuts at this time indicated that only clopyralid 300 g/L + florasulam 50 g/L+ MCPA LVE 500 g/L, aminopyralid 10 g/L+ fluroxypyr 140 g/L and chlorsulfuron 750 g/kg had resulted in a significant reduction in plant biomass compared with the control ($P < 0.05$, Table 1).

Eleven herbicides provided greater than or equal to 80% weed control by 15 DAT. Similarly, by 26 and 40 DAT, 11 treatments provided greater than or equal to 80% weed control. In contrast, dicamba 500 g/L, metsulfuron-methyl 600 g/kg, chlorsulfuron 750 g/kg, triclopyr 600 g/L, triclopyr 300 g/L + picloram 100 g/L + aminopyralid 8 g/L, metosulam 100 g/L, flumioxazin 500 g/kg and clopyralid 300 g/L only controlled up to 77% of weeds present.

Using these data, the Grassland Society of NSW applied for a minor use permit from the Australian Pesticides and Veterinary Medicines Authority (APVMA) for nine herbicides and mixtures. Eight are denoted in Table 1 by bold font and the ninth herbicide was triclopyr 300 g/L + picloram 100 g/L with an application rate of 2 L/ha identified from separate studies (A Cook, unpublished data). This permit (number PER12362 in force 3 February 2011–30 November 2015) allows those establishing tropical perennial grass pastures a wider choice of post-emergent herbicides and mixtures to target the different weed species experienced with summer establishment of pastures and can be obtained from www.apvma.gov.au/permits/search.php.

Table 1. Weed control (%) and reduction in sown pasture biomass (%) compared to the control 15, 26 and 40 days after treatment (DAT). Herbicides that can be used on tropical perennial grasses in NSW have bold text (permit number PER12362).

Treatments	Rate product/ ha	15 DAT		26 DAT		40 DAT	
		Weed control (%)	Pasture biomass reduction (%)	Weed control (%)	Pasture biomass reduction (%)	Weed control (%)	Pasture biomass (kg DM/ha
2,4-D amine 625 g/L	1.7 L	92	20	99	10	86	3072
fluroxypyr 200 g/L	1.0 L	85	40	96	15	95	4357
metsulfuron-methyl 600 g/kg + MCPA LVE 500 g/L	5 g + 0.5 L	93	29	96	9	96	3612
2,4-D amine 625 g/L + triclopyr 600 g/L	1.7 L + 0.3 L	81	28	90	3	88	3852
2,4-D amine 720 g/L	1.5 L	88	5	90	5	92	4108
metsulfuron-methyl 600 g/kg + aminopyralid 10 g/L+ fluroxpyr 140 g/L[1],	5 g + 0.75 L	79	10	88	2	85	4547
metsulfuron-methyl 600 g/kg + 2,4-D amine 720 g/L	5 g + 1.5 L	86	15	87	0	84	4393
MCPA amine 500 g/L	2.0 L	86	7	86	9	84	3635
aminopyralid 10 g/L + fluroxypyr 140 g/L	0.75 L	83	19	81	4	93	2463
chlorsulfuron 750 g/kg	10 g	78	18	81	23	71	1927
clopyralid 300 g/L + florasulam 50 g/L	0.75 L	83	16	67	3	62	2638
clopyralid 300 g/L + florasulam 50 g/L+ MCPA LVE 500 g/L	0.75 L + 0.5 L	89	7	93	15	88	2658
dicamba 500 g/L	2.0 L	69	20	67	2	77	3518
metosulam 100 g/L[2]	7 g	33	42	67	14	25	3815
metsulfuron-methyl 600 g/kg	5 g	36	2	67	1	73	3744
bentazone 480 g/L	2.0 L	83	30	62	12	90	3965
triclopyr 600 g/L	0.5 L	40	11	50	10	51	3026
triclopyr 300 g/L + picloram 100 g/L + aminopyralid 8 g/L	0.3 L	52	7	47	5	42	2722
flumioxazin 500 g/kg	60 g	29	17	16	7	19	4032
clopyralid 300 g/L	0.3 L	7	31	9	13	7	2951
Nil (control)	–[3]	0	0	0	0	0	3844
lsd (P = 0.05)		24.2	21.4	22.7	15.8	32	1684

[1] Chem wet added to tank mix [2] Uptake added to tank mix [3] No rate applicable.

Acknowledgments

The authors wish to thank the Grassland Society of NSW Inc for applying to APVMA for a permit to use these herbicides and mixtures on tropical perennial grasses in NSW, A. and R. Whelan "Montarey", Loomberah for providing the experimental site and P Moylan, S Squires and C Bowman, Department of Primary Industries (formerly Industry & Investment NSW), Tamworth for collecting the data.

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