Herbicide options for broad-leaved weed control in seedling chicory

Belinda Hackney [1,2], Brian Dear [1,2], Richard Hayes[1,2], Gabrielle Dyce [1] and Craig Rodham[1]

[1] E H Graham Centre for Agricultural Innovation (NSW Department of Primary Industries and Charles Sturt University), Wagga Wagga Agricultural Institute, PMB, Wagga Wagga, NSW 2650. Email: belinda.hackney@dpi.nsw.gov.au
[2] CRC for Plant Based Management of Dryland Salinity, 35 Stirling Highway, Crawley

Abstract

Twenty commonly used broad-leaved herbicides and herbicide mixtures were applied to seedling chicory to identify herbicides with potential to control weeds in the establishment phase. Damage was assessed visually and through harvest of plants 10 and 30 days after spraying (DAS). Four herbicides, flumetsulam (Broadstrike?), Imazamox (Raptor?), simazine and Imazethepyr (Spinnaker?) caused minimal levels of damage. Three mixtures, flumetsulam (Broadstike?)/bromoxynil, simazine/diflufenican (Brodal?) and simazine/ flumetsulam (Broadstrike?) also caused minimal damage to seedling chicory. Lack of suitable herbicide options for the control of broadleaf weeds has limited the adoption of chicory, potentially a very valuable plant, in farming systems. This research has identified herbicides that may overcome this limitation.

Keywords

Chicory, broad-leaf weeds, herbicides

Introduction

Chicory (*Cichorium intybus* L.) is a deep-rooted perennial herb capable of producing high quality forage particularly over the summer months. This trait is particularly valuable in areas of southern Australia where pasture quantity and quality frequently limit animal production at this time of year (Andrews 1997). Previous research (Kemp *et al*. 2002) showed that chicory established readily across a range of sites with differing soil and climatic conditions and was more productive than lucerne (*Medicago sativa* L.) at many of these sites. Chicory is better adapted than lucerne to low pH soils often encountered in southern Australia and has the additional benefits of not causing bloat or red-gut in grazing animals (Upjohn *et al*. 2005). Despite its wide area of adaptation and livestock production benefits, the incorporation of chicory into grazing systems has been slow. There are several possible reasons for this. Compared to traditional pastures containing perennial grasses and annual legumes, chicory requires a higher level of management, incorporating rotational grazing through its growth period and spelling over winter to encourage long-term production and persistence (Upjohn *et al.* 2005). Additionally, it has been noted, though not well quantified, that chicory is more sensitive to herbicides used to control broad-leaved weeds in pastures and the general recommendation is to avoid sowing chicory where broad-leaved weeds are likely to be encountered (Upjohn *et al*. 2005). However, given that weeds are an inevitable problem faced by farmers, and spraying to control these weeds is common practice, it is important that the sensitivity of chicory to a range of commonly used broad-leaved weed herbicides is well understood. This is particularly important in the establishment year of a pasture as this is the period when weed control can mean the difference between a successful long-term and failed pasture.

The objective of this glasshouse experiment was to determine the tolerance of seedling chicory to a range of commonly used broad-leaved herbicides and herbicide mixtures. Seedling lucerne was used as a comparative control.

Methods

Puna chicory and Aurora lucerne were sown into individual 10 cm diameter plastic pots containing a red-brown earth pH_{CaCl} 5.2. The pots were arranged in a split-plot design with varieties as main plots and

herbicides as sub-plots. The experiment was replicated three times. Following germination, plants were thinned to eight per pot. When chicory reached 4-5 leaf stage, herbicides were applied to pots in a spray cabinet using a water rate of 100L/ha. Visual estimation of damage was made 10 and 30 DAS by two observers independently. Only the results 30 DAS are presented here. The damage score range from 1 (no damage), through to 10 (plant death). Scores of 4 or less indicate recoverable levels of damage, that is severe yield reduction may have occurred but plants did recover. Throughout the experiment pots we watered to free-draining and the glasshouse temperature was maintained at 22/14?C.

Results

In general, the damage to seedling chicory as a result of herbicide application was greater than that sustained by seedling lucerne (Table 1). Herbicides and mixtures commonly used to control thistles in pastures (those containing 2,4-DB, Jaguar?, Lontrel?, 2,4-D amine and MCPA) were particularly damaging to chicory. Herbicides/mixtures which appear to have potential for control of other broad-leaved weeds are Broadstrike?, Raptor?, Spinnaker?, simazine, Broadstrike?/bromoxynil, simazine/Brodal?, simazine/Broadstrike? and Spinnaker?/Brodal?.

Table 1. Damage scores of seedling lucerne, chicory and plantain 30 days after spraying with a broadleaf herbicide (1=no damage, 10=complete plant death, scores of 4 and below are shaded in grey and indicate damage from which plants could subsequently recover)

Common name	Active ingredient	Rate/ha	Lucerne	Chicory
Broadstrike?	Flumetsulam (800g/L)	25g	1	2.5
Bromoxynil	Bromoxynil (200g/L)	1.4L	2	9
Raptor?	Imazamox (700g/L)	40g	1	3
Spinnaker?	Imazethepyr (240g/L)	300mL	1.5	3
2,4-DB	2,4-DB (500g/L)	2L	1.5	6.5
Jaguar?	Bromoxynil(250g/L)+Diflufenican (25g/L)	750mL	3	9.5
Brodal	Diflufenican (500g/L)	200mL	3.5	5.5
2,4-D amine	2,4-D amine (625g/L)	1.7L	8	10
Cadence?	Dicamba (700g/kg)	200g	9.5	9.5
Igran?	Terbutryn (500g/L)	550mL	5	8.5
Lontrel?	Clopyralid (300g/L)	70mL	9	9.5

MCPA 500	MCPA as dimethyl amine salt (500g/L)	750mL	7.5	9.5
Simazine	Simazine (900g/kg)	550g	2.5	1.5
Broadstrike?/Bromoxynil	Flumetsulam (800g/L) + Bromoxynil (200g/L)	25g/700mL	2.5	3.5
Broadstrike?/MCPA	Flumetsulam (800g/L) + MCPA as dimethyl amine salt (500g/L)	25g/500mL	8	10
Igran?/MCPA	Terbutryn (500g/L) + MCPA as dimethyl amine salt (500g/L)	550mL/300mL	8.5	10
Simazine/Brodal?	Simazine (900g/kg) + Diflufenican (500g/L)	550g/200mL	3.5	3
Simazine/Broadstrike?	Simazine (900g/kg) + Flumetsulam (800g/L)	550g/25g	2	2.5
Simazine/MCPA	Simazine (900g/kg) + MCPA as dimethyl amine salt (500g/L)	550g/300mL	4	10
Spinnaker/Brodal?	Imazethepyr (240g/L) + Diflufenican (500g/L)	300mL/200mL	2.5	3

Conclusion

Results of this preliminary study indicate that there are several herbicides/mixtures that have the potential to control a wide variety of broad-leaved weeds in seedling chicory. However, all herbicides/mixtures evaluated with the potential to control thistles in pasture situations caused unacceptable levels of damage to seedling chicory. Therefore it would be advisable to avoid sowing pastures containing chicory into areas where thistle problems are anticipated. Further research is required to clarify these findings under field conditions.

References

Andrews A. (1997) Feed year planning and grazing management. In. Pasture Production and Management Eds JV Lovett, JM Scott. pp. 207-230, Inkata Press, Melbourne

Kemp DR, Michalk DL and Goodacre M (2002) Productivity of legumes and chicory in central New South Wales. Australian Journal of Experimental Agriculture 42, 15-25.

Upjohn B, Parker M and Kemp D (2005) Chicory. Agfact P2.5.40 (third edition), NSW Department of Primary Industries.