Herbicide tolerance of seedling perennial grasses–options for improving establishment.

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Abstract

Incorporating perennial grasses as part of the pasture-crop rotation can convey significant benefits. They can fill the autumn-winter feed gap, produce feed at times when lucerne is unproductive, reduce the risk of bloat and red gut in livestock and compete strongly with weeds. Establishing them in a pasture phase can be more difficult than lucerne or annual legumes. Competition from grass weeds such as annual ryegrass and wild oats can affect the reliability of establishment of perennial grasses. Incorporating perennial grasses in the pasture mix will also limit the range of pre and post-emergent herbicides that can be applied if sown under a cereal cover crop. This paper summarises glasshouse screening studies of the selectivity of pre and post-emergent grass herbicides on cocksfoot, fescue and phalaris seedlings. The pre-emergent herbicides included Logran®, Treflan®, Stomp®, Yield® and Sencor® and the post-emergent herbicides were Achieve®, Fusilade®, Mataven®, Puma®, Sertin®, Hoegrass® and simazine. All the grass herbicides caused moderate to severe phytotoxicity in the perennial grass seedlings. Given the lack of suitable selective herbicides it is suggested that other weed control strategies need to be employed. Options available include removal of annual grass weeds during the prior cropping phase, or delayed sowing until early spring following a winter fallow.

Introduction

Although lucerne is widely used in the mixed farming zone, perennial grasses are not routinely used in the pasture phase in rotations with crops. Their use is mostly restricted to long-term perennial pastures. Some farmers have successfully introduced them in phased pastures in rotation with crops where they can make a significant contribution in terms of stock health, the feed year, weed control and soil structure. This paper discusses the contribution perennials grasses can make in phased rotations, reasons for their low adoption, herbicide tolerance and strategies for improving their establishment.

Why introduce perennial grasses?

Annual pastures have a relatively narrow growing period with high quality feed being limited to late winter and spring. Outside this period either feed availability or herbage quality is limiting with livestock often relying on low quality dry residues. It can be difficult to finish animals to meet market specifications where the feed base consists largely of annual species because of the inability to supply feed of high quality when it is required. Winter feed supply is becoming increasingly unreliable as late breaks to the growing season and increasing climate variability further affect regeneration and autumn-winter production by annual pastures. Introducing lucerne into the farming system increases feed production in spring and can make better use of summer rain but can further exacerbate the winter feed shortage. Strong competition between lucerne and annual legumes (Dear and Cocks 1997) often results in bare areas between the lucerne and a reduction in winter productivity of the annual legumes.

Perennial grasses have the advantage of producing the bulk of their growth in the autumn-winter-spring period, thus supplying feed when production by annual pastures and lucerne is limiting. While the use of perennial grasses may have been limited in the past due to their sensitivity to drought, a greater range of cultivars has expanded the areas in which they are suited and cultivars such as Kasbah cocksfoot, Atlas PG phalaris and Fraydo fescue can now be reliably grown in the 400–500 mm wheat belt which was previously too dry for perennial grasses.

Another advantage of including perennial grasses is their ability to compete with weeds. The presence of weeds in a pasture is a sign that available resources are not being fully utilised. The narrow growing period of annuals and their slow start in autumn can result in key resources such as soil water and soil mineral nitrogen (N) not being effectively used, creating a opportunity for weeds to exploit. Perennial grasses have the capacity to respond to non-seasonal rain as well as utilising N as it mineralises (Dear *et al.* 1998) greatly reducing the ability of weed seedlings to establish.

Herbicide tolerance of perennial grass seedlings

Studies of herbicide tolerance of perennial grass seedlings have identified few options for controlling annual grass weeds. Commonly used guides to weed control in grass pastures for example list no grass-selective herbicides that can be safely used in newly established perennial grass pastures (Dellow and Scott 2005). A glasshouse study by Dear *et al.* (2006) examined the herbicide tolerance of cocksfoot (*Dactylis glomerata*), phalaris (*Phalaris aquatica*), and tall fescue (*Festuca arundinacea*), to Logran® (3L/ha), Treflan® (1.5 L/ha), Stomp® (2 L/ha), Yield® (1.6 L/ha), Sencor® (0.43 L/ha), Achieve® (0.38 kg/ha), Fusilade® (0.25 L/ha), Mataven® (4.5 L/ha), Puma® (0.5 L/ha), Sertin® (0.6 L/ha), Hoegrass® (1 L/ha) and simazine (1.25 L/ha). Annual ryegrass was included as a typical weed species. The study found all the pre and post-emergent herbicides evaluated caused moderate to severe growth reduction in the perennial grass seedlings. The damage was expressed in terms of visual scores of leaf damage and seedling retardation 30 days after spraying (1= no effect, 9 = all plants dead) (Figure 1) and in plant weights 30 days after spraying (Figures 2 and 3). All of the pre-emergent herbicides caused large yield reductions and were not viable options. Of the post-emergents Mataven® showed promise in phalaris, fescue and cocksfoot with visual damage scores <4 and yield depressions ranging from 10–60%. Although Mataven® was not effective at controlling annual ryegrass it proved very effective at controlling wild oats (Dear *et al.* 2006). Similarly simazine, although soft on the perennial seedlings, was also relatively ineffective at controlling annual ryegrass. A more detailed description of the leaf damage and yield depression is given in Dear *et al.* (2006).

As the studies were conducted in a glasshouse it is likely that their effects may vary when used in the field and the results only give a guide to possible effects. One of the herbicides in the study, Mataven®, was subsequently applied to seedling phalaris in the field to control competing wild oats. A yield reduction in the phalaris of about 40–50% was consistent with that observed in the glasshouse and the plants subsequently recovered with good wild oat control.

Non herbicide weed control options

Given the lack of highly selective grass herbicide options, avoiding weed competition at establishment is the only reliable strategy and is preferable to attempting to resurrect a newly sown weedy pasture. Where the prior crop has been kept clean of grass weeds, particularly wild oats and annual ryegrass, competition from grass weeds is normally not an issue and an autumn sowing is the preferred strategy. This allows the pasture grasses and accompanying annual legumes to be sown directly or alternatively undersown under a light cereal or canola cover crop in autumn. Where there is a high risk of grass weeds, delaying sowing and fallowing the paddock over winter, either chemically or through cultivation, will allow most of the weed grass seedlings to germinate and be controlled prior to a later sowing in early spring (mid August–early September). The main disadvantage of a spring sowing is that it allows less time for establishment prior to the summer drought and other weeds are likely to be a problem, particularly summer weeds such as wireweed (*Polygonum aviculare*). Annual legumes cannot be sown in spring and still set seed so they would need to be oversown in the following autumn.

Conclusions

Perennial grasses can make a major contribution to the stability of the pasture and fill the autumn-winter feed deficit. Their main limitation is the increased attention required to reduce competition from weeds during the establishment phase. The potential benefits are sufficient to warrant the higher level of management required.

References

Dear, B.S. and Cocks, P.S. (1997). Effect of perennial species on surface soil moisture and early growth and survival of subterranean clover (*Trifolium subterraneum* L.) seedlings. *Australian Journal of Agricultural Research* **48**, 683-693.

Dear, B.S., Cocks, P.S., Wolfe, E.C. and Collins, D.P. (1998). Established perennial grasses reduce the growth of emerging subterranean clover seedlings through competition for water, light and nutrients. *Australian Journal of Agricultural Research* **49**, 41-51.

Dear, B.S., Sandral, G.A. and Wilson, B.C.D. (2006). Tolerance of perennial grass seedlings to pre- and post-emergent grass herbicides. *Australian Journal of Experimental Agriculture* **46**, 637-644.

Dellow, J.J. and Scott, M.C. (2005) Weed control in lucerne and pastures 2005. NSW Department of Primary Industries, Orange. New South Wales.

Disclaimer

Some of the herbicides used in this study may not be registered for use on pastures and the label should be consulted to ensure the product can be used for the intended application.

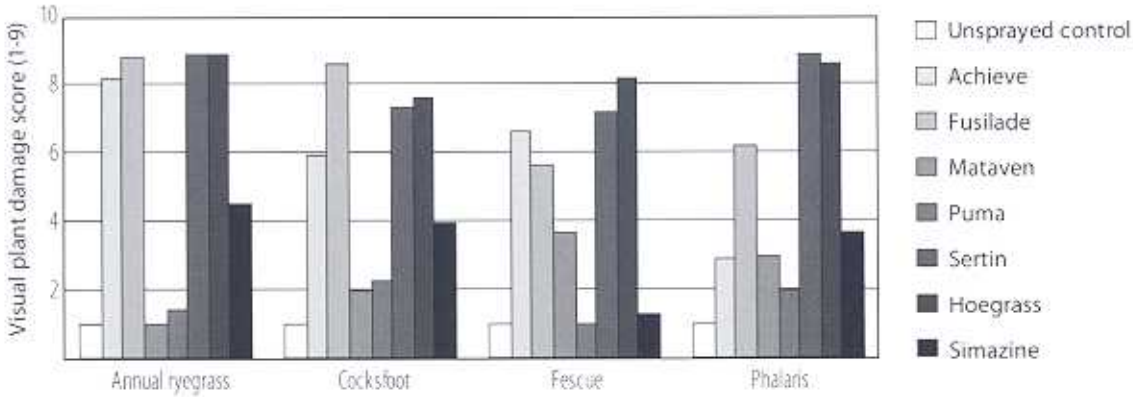

Figure 1 Visual leaf damage score 30 days after applying seven post emergent herbicide (1= no damage, 9 = all plants dead).

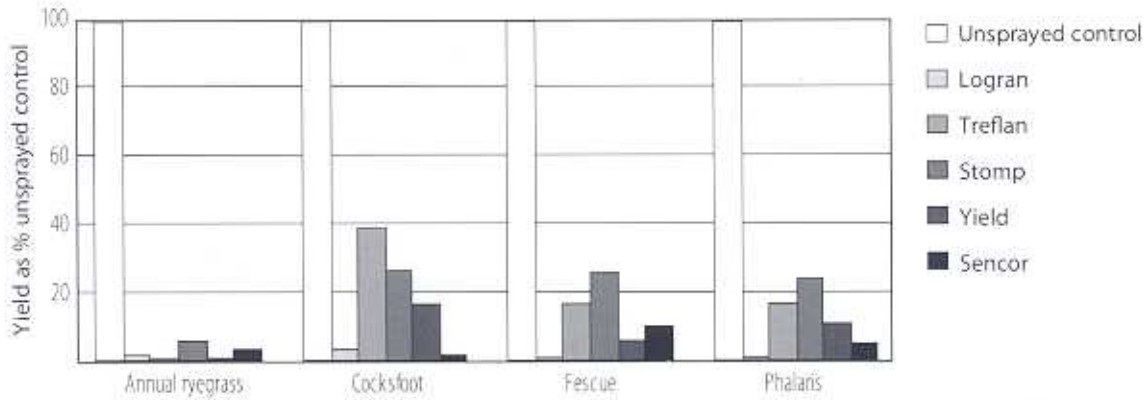

Figure 2 Grass seedling weights 45 days after application of five pre emergent herbicides expressed as a % of the unsprayed control.

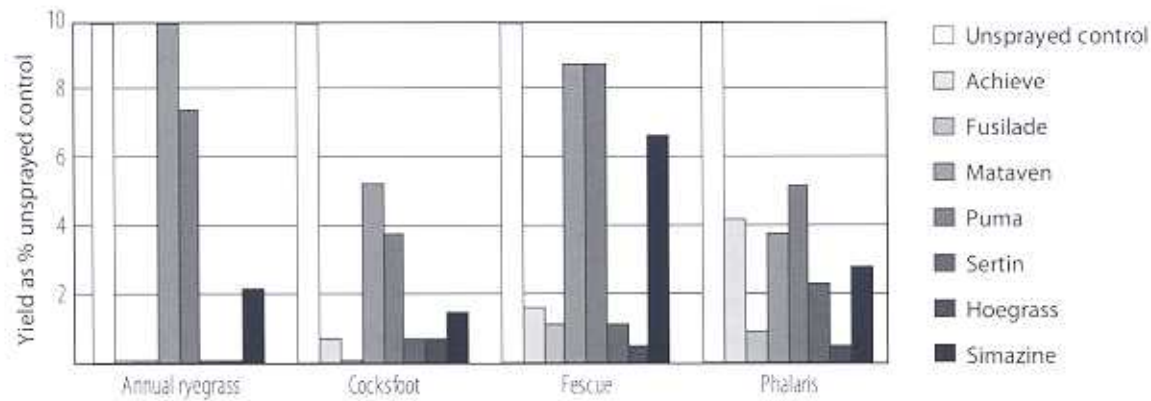

Figure 3 Grass seedling weights 30 days after application of seven post emergent herbicides expressed as a % of the unsprayed control.