How do I know if herbicide application will improve my pasture?

The issue:	Weeds can reduce pasture productivity, but controlling weeds with herbicide does not always provide all the answers and requires careful management to realise the benefits.
The impact:	Improvement in desirable grasses and clovers enables a pasture to reach its productive potential and extend its persistence.
The opportunity:	Weed control can be a low-cost, high-benefit tactic to improve the productivity and life of a pasture, but only under the right conditions.

Taking control

Herbicides can be a useful tool to alter the composition of a pasture, either through direct action or when combined with grazing management. Selectively removing or suppressing unwanted plants results in less competition for desirable species, providing an opportunity for those species to increase in size and occupy vacant spaces. Good weed management can deliver significant gains in the quantity and quality of pastures.

However, the effect can be short-lived if the underlying reasons for the presence of the weed are not understood and addressed, or if there are insufficient desirable species to take advantage of the reduced competition (see *Increasing competition the key* on the next page).

Before (left) and after (right) winter cleaning with herbicide to remove annual grasses. The estimated cost of application and loss of winter production was $89/ha. Herbicide application provided an equivalent annual return of $125/ha for five years.[1]

Increasing competition the key

In a winter pasture cleaning trial at Ararat, Victoria, without follow-up action, silver grass returned to populations similar to the untreated control after two years.[2] The lowest silver grass content was achieved from treatments that involved winter cleaning in combination with fertiliser application and a long rest from grazing (from October to April), which strengthened the phalaris.

How do I decide what action to take?

There are five important considerations to establish if weed control is warranted.

1. What problems are the weeds causing?

All pastures will contain species that may not have been sown. Most only contribute to a small proportion of the overall pasture mix, and are often of similar quality to the desirable species when vegetative (Table 1). They can also add to the feed available early in the season.

Table 1. Feed quality of common weeds compared to perennial grass and sub-clover at the same vegetative growth stage during winter.[3]

Species	Digestibility (%)	Metabolisable energy (MJ ME/kg DM)	Crude protein (%)
Perennial ryegrass	80	12	23
Sub-clover	79	12	29
Capeweed	83	13	24
Dock	84	13	31
Barley grass	79	12	14
Winter grass	79	12	17
Erodium	78	12	26
Fog grass	77	12	24
Silver grass	65	10	12

In many cases, these plants remain in small quantities from year-to-year and generally do not dramatically impact pasture quantity or quality.

However, problems arise when plants:

- significantly displace or compromise growth of desirable species through competition for light, water and nutrients, such as silver grass and sub-clover, capeweed and perennial grasses
- cause animal health issues, carcase damage or fodder contamination as seen in weeds including barley grass, erodium, nightshade and Paterson's curse
- shorten seasonal production by flowering earlier (e.g. the winter grass *Poa annua* and silver grass)
- create areas of exposed soil over summer that could erode, such as capeweed causing bare hills.

These negative effects are why some plants are considered weeds. They are unwanted because of the problems they create, despite often having positive features. Common weeds found in pasture and their undesirable features are listed in Table 2.

Barley grass, with its fast growth, successfully competes for space and resources against the slower-growing sub-clover.

Silver grass shortens seasonal production by flowering earlier than improved perennial grasses.

Barley grass seed has entered the gland under the sheep's eye and contaminated the wool and, potentially, the carcase.

Capeweed finishes early to leave bare hills.

Table 2. Common unsown species found in pasture and their undesirable features.

Species	Compromises growth of desirable species	Causes animal health issues or product contamination	Reduces seasonal pasture production	Poses an environmental risk*
Annual (Wimmera) ryegrass#	X	X^	X	
Barley grass	X	X	X	
Bent grass	X			
Capeweed	X		X	X
Erodium	X	X	X	X
Fat hen		X		
Flatweed	X		X	
Fog grass	X			
Onion grass	X	X	X	
Silver grass	X	X	X	
Soft brome grass	X	X	X	
Sow thistle	X			
Winter grass			X	
Wireweed	X		X	

* Environmental risk is defined as a plant that disintegrates and creates bare ground over summer, exposing the soil to erosion.
\# Annual ryegrass may be considered a desirable species in some situations.
^ Annual ryegrass toxicity mainly applies to WA and SA.

2. What are the desirable species to fill the gaps once weeds are removed?

Removing weeds provides an opportunity for other plants to occupy the bare spaces created. This may be through encouraging existing species to tiller or seed, or by introducing new species through over-sowing. If there are insufficient desirable species to fill the gaps, weeds may just replace themselves.

Other conditions may also need to be altered to achieve lasting control. Improvements to soil fertility, soil acidity and the method of grazing may be required to sustain the effectiveness of the herbicide treatment.

This can be challenging when target weeds thrive in conditions that favour the desirable species, such as barley grass. Repeat interventions at regular intervals may be required.

The minimum desirable perennial grass population should be:

- 30 perennial ryegrass plants/m^2
- 10 phalaris, tall fescue, cocksfoot plants/m^2.

A minimum of 15 sub-clover plants/m^2 is also required in legume-based pastures.

The Pasture Paramedic tool provides a simple way to rapidly assess desirable species populations.

3. What is the most appropriate technique to use?

There are three herbicide-based approaches to control common weeds in established temperate pastures. These are spray-grazing, winter cleaning (for silver grass *Vulpia* species) and spray-topping. All techniques are well tested and proven to be effective on many common pasture weeds.

Additional herbicide options are available to remove specific weeds, but they may be incompatible with the survival of specific desirable grasses or clovers. Refer to the label and consult an experienced agronomist to check the suitability of the herbicide.

More details on each of these techniques are available in MLA fact sheets:

How do I spray-graze to remove broadleaf weeds?

How do I winter clean pastures to remove annual grass weeds?

How do I spray-top to reduce annual weeds in pastures?

A list of treatment options and the broad timing of applications for common pasture weeds is presented in Table 3. Some weeds have multiple treatment options.

Table 3. Herbicide tactics for manipulating common pasture winter weeds in perennial grass/clover pastures.

Weed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barley grass (*Hordeum leporinum* and *H. glaucum*)				selective						spray-top		
					winter clean							
Silver grass (*Vulpia* spp)					winter clean			winter clean		spray-top		
Soft brome grass *(Bromus hordeaceus)*				selective								
					winter clean					spray-top		
Capeweed *(Arctotheca calendula)*					spray-graze				spray-top			
				selective								
Bent grass (*Agrostis* spp)											seed-head suppression	
Fog grass *(Holcus lanatus)*											seed-head suppression	
Onion grass *(Romulea rosea)*							selective					
Sorrel *(Acetosella vulgaris)*									selective			
Erodium *(Erodium botrys)*					spray-graze							
				selective								
Thistles e.g. spear thistle *(Cirsium vulgare)*					spray-graze							
				selective								
Wild radish *(Raphanus raphanistrum)*					selective							
Wireweed/hogweed (*Polygonum* spp)				selective								

Indicative timing only – read label for critical comments regarding stage of growth

4. What is the cost of treatment?

There are both direct and indirect costs associated with any treatment. The direct costs include the herbicide and application costs.

Table 4. Indicative costs of direct herbicide treatment (herbicide and spraying).

Treatment	Direct cost# ($/ha)
Spray-grazing	$20–$27
Winter cleaning	$23–$26
Spray-topping	~$20
Selective herbicides	$20–$33

Calculated from minimum and maximum label rates and 2020 product costs for suitable products + 60% of 2020/21 contract spraying rates (agcontracting.org.au).

~ approximately equal

Indirect costs are more difficult to quantify, and include considerations like the immediate reduction in pasture production, delays in grazing due to withholding periods, suppression of future growth and possible declines in other, more desirable, non-target species. In years of low feed supply, the 'cost' of reduction in pasture feed may be significant, because the loss of feed needs to be replaced by supplements (or through losses in animal performance). In years of abundant feed, indirect costs are reduced significantly. Estimates of the losses using the common weed control approaches are provided in Table 5.

Table 5. Indicative loss of pasture production through common herbicide techniques.

Treatment	Production loss
Spray-grazing	10–40% for eight weeks
Winter cleaning	Up to 50% for eight weeks
Spray-topping	20% for four weeks

A simple approach is to calculate the cost of providing a supplement of equivalent energy to the feed lost (see *Calculating the indirect cost of weed control*).

5. What is the benefit of treatment?

Multiple benefits can result from herbicide application, but quantifying these is difficult.

The most direct benefit is the increase in the amount and quality of pasture grown. More desirable grasses can extend seasonal growth and increased legume content has the dual benefit of better animal performance and soil nitrogen.

Other benefits can include reductions in carcase and fleece contamination, animal health issues and environmental exposure. The reasons identified in step 1, *What problems are the weeds causing?* provides a good checklist to identify possible areas of benefit.

A less obvious benefit is the prolonged life of the pasture. Studies indicate it commonly takes between five and eight years to break even after a full pasture renovation,[1] so extending the productive life of a pasture has long-term benefits.

At a minimum, the benefits need to cover the direct and indirect costs of the treatment.

Calculating the indirect cost of weed control

Most weed control treatments are applied in late autumn to early spring, when pastures are typically around 80% digestible (approximately 12 MJ ME/kg – see Table 1). An equivalent supplement of this feed quality is around $210/tonne.* Therefore, if there was a 1t/ha decline in the pasture available and 50% of this pasture was utilised, then the indirect cost would be about $105/ha (1t/ha x 50% utilised @ $210/t = $105/ha).

* Based on 2c/MJ ME/kg, calculated from average quality and prices for oats, feed barley and grass hay.

Source: Feedtest 2018 to 2020, agprice.grainandgraze3.com.au (2017–2020).

Weighing up the pros and cons

Weed control decisions require appreciating and comparing the benefits and costs, or the pros and cons.

A good start is this simple five step approach to assess these.

1. **Rate the weed problem**. Using Table 2, consider the number of 'Xs' against the dominant weeds. The more 'Xs', the greater the problem the weed may pose, especially in large quantities.
2. **Rate the presence of desirable species to fill the gaps**. Using *Pasture Paramedic* or a similar pasture composition assessment technique, determine if enough desirable plants exist to fill the gaps vacated by removed weeds.
3. **Identify the best herbicide technique to consider**. Refer to Table 3 to determine the approach and timing. Appreciate the requirements to make the technique work by referring to the MLA fact sheets: *How do I* on spray-topping, winter cleaning, spray-grazing and use of selective herbicides.
4. **Assess the costs and benefits**. Refer to the suggested method of calculating costs and benefits. These may vary greatly from one season to the next due to changing indirect costs.
5. **Appreciate what other changes may need to be made to maximise the benefits**. This could involve fertiliser, lime, grazing or over-sowing desirable grasses or legumes.

To simplify the process, a decision matrix has been developed to enable a rapid assessment of the key considerations (Table 6). Circle the score more closely reflecting your response, add them up and consider them against the suggested decisions.

Table 6. Do I apply herbicide treatment to this paddock?

Critical factors	Condition descriptions	Score
Problem the weed is causing	High, major undesirable features (high-level competition and production loss, significant animal and/or environmental impacts)	8
	Moderate, some undesirable features	3
	Low, minor losses or just looks untidy	0
Capacity for desirable plants to fill the gaps	High, species will fill gaps under current management	6
	Moderate, species will partly fill the gaps but requires management changes or improvements for this to occur	4
	Low, few desirable species present	0
Benefits compared to costs of the treatment	Benefits easily exceed direct and indirect costs and are realised quickly	6
	Direct and indirect costs are similar to benefits, around break-even	3
	Direct and indirect costs significantly higher than likely benefits	0
Actions to make the treatment long-lasting	Minimal investment or management changes required	5
	Some changes in operation or investment required (such as grazing, fertiliser etc)	3
	Significant changes or investment required	0
	Max score	**25**

Decision	Total score
Yes, apply herbicide treatment	Greater than 16
No, don't apply herbicide	Less than 16

NB: This decision matrix is an example only. Users are encouraged to critically examine and modify the critical factors, condition descriptions about the decision and scores as they believe is appropriate to their situation.

The herbicide label provides all the critical comments and precautions for the safe and responsible use of herbicides using the described techniques. Always read the label and only use as directed.

References and more information

1. Joseph K (2017) *South West Prime Lamb Group (SWPLG) – Perennial pasture persistence*, MLA project B.FDP.0052 final report, MLA, Sydney.
2. Tozer KN, Chapman DF, Quigley PE, Dowling PM, Cousens RD and Kearney GA (2009) Integrated management of *Vulpia* in dryland perennial pastures of southern Australia, *Crop and Pasture Science* 60, 32–42.
3. Brogden J, (2021) *Feed quality of common pasture weeds*, 2021 trial results, Southern Farming Systems.

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