



# Non-chemical weed control supports sustainable integrated strategy

## Key facts

- Relying on herbicides as single weed control strategy is fraught with danger and will increase the speed of onset of herbicide resistance.
- A range of non-chemical weed control options is available, which will prolong the life of current herbicides and offer a range of NRM benefits.
- Selecting suitable non-chemical weed control strategies will depend on the target weed, paddock history and available resources.

**A wide range of non-chemical weed control options exists** (Table 1) and it is critical growers use these alternative control methods to complement and protect the efficacy and longevity of currently-available herbicides.

Low-risk, low-cost non-chemical control options, such as those described here, that have a high chance of success are best suited to low-rainfall cropping areas.

### Increased crop competition

Encouraging increased crop competition to suppress weed growth can be achieved in many ways, including: crop species and varietal selection, early sowing, reducing row spacing, increasing sowing density, and improving sowing accuracy.

Including more competitive crops (e.g. barley) in the rotation, and selecting varieties with greater early vigour reduces weed competition and seed set.

*The sole reliance on herbicides for weed control is unsustainable given the increasing development of herbicide resistance, limited herbicide options for particular weeds or crop types and the ongoing change in behaviour of weed populations in response to ever-changing farming practices.*

Narrow row spacings (18–25cm) and sowing rates at the higher end of district recommendations will increase competition through greater crop density. If tyne spacing is wider than 25cm, then 'splitter boots' can be used to effectively reduce row spacing.

Paying attention to sowing accuracy, with a particular focus on sowing depth (e.g. not too deep or shallow), is important in establishing a competitive crop.

Agronomic practices that limit root disease, insect damage and nutritional deficiencies also help to promote early crop vigour reducing the opportunity for weeds to compete with the crop.

When looking to use increased crop competition as a key weed control strategy, keep in mind that one major downside, particularly in low-rainfall areas, is the potential to exhaust limited soil moisture reserves during spring, leading to reduced grain yield and grain size. Keep sowing rates within district recommendations to limit this risk.



*PREVIOUS PAGE: Sowing on narrow rows and increasing sowing rates can increase the overall competitiveness of the crop over the weeds, making it more difficult for weeds to establish. Photo: Ben White*

*ABOVE: Sowing accuracy, using precision agriculture technology, can increase crop competitiveness. Photo: David Gooden*

*RIGHT: Hay production can remove weeds and weed seeds from a paddock, effectively reducing the weed seedbank. Photo: Andrew Storrie, Agronomo Consulting*



### Hay production

Cutting and baling crops or pasture for hay can result in up to 95 per cent control of many weed species provided grazing or spray-topping is used to control regeneration or germination of weeds after hay is removed.

### Crop row orientation

Research carried out in Western Australia has revealed sowing in an east-west direction can reduce weed competition and seed set in annual ryegrass. This is due to the crop intercepting more sunlight than the weeds when sown from east to west compared with a north-south orientation, giving the crop a competitive advantage, particularly early during the season.

### Full-cut cultivation

Full-cut cultivation is effective if weeds have emerged (and reached the 3-4 leaf stage) at the time of cultivation. Although suited to most weed types, full-cut cultivation does not suit all soil types because of the high risk of erosion with this practice. Heavy clays are most suited to full-cut cultivation.

### Weed-free seed

Keeping grain from 'clean' paddocks for future crop production and using a professional seed cleaner can both significantly reduce the number of weed seeds likely to be present in the crop seed, effectively reducing the overall weed seedbank and preventing further spread from paddock to paddock.



*ABOVE: Sowing weed-free seed reduces the overall weed seedbank and is a cost-effective non-chemical control option.*

*BELOW: Crop orientation can impact on the ability of weeds, such as annual ryegrass, to thrive, as east-west-sown crops intercept more sunlight than the weeds. Photos: Ben White*





ABOVE: Harvesters can easily be equipped to produce narrow windrows.  
LEFT: Narrow windrow burning is a low-cost, highly-effective non-chemical weed control option in low-rainfall areas. Photos: Ben White

**Table 1. Evaluation of non-chemical weed control methods for low-rainfall cropping regions of south-eastern Australia**

Weed control method	Likelihood of success in low-rainfall regions	Adoption cost	Potential issues, risks and considerations
Increased crop competition by manipulating crop species, variety, sowing time, row spacing, sowing density or sowing accuracy	High	Low	Too much crop competition can exhaust available soil moisture early leading to reduced yields and grain size. Narrow row spacing requires attention to residue management for problem-free sowing.
Crop row orientation (east-west)	Medium	Low	May not suit all paddocks.
Full-cut cultivation	High*	Medium	Increased erosion risk. May bury some weed seeds away from the region of herbicide activity.
Weed-free seed	High	Low <sup>^</sup>	Nil
Hay production	High	High	Specialised equipment or contractors may be required. High transport costs.
Stubble burn	Low	Low	Stubble loads in low-rainfall regions are often too low (<2t/ha) for an effective burn. Stubble burning increases erosion risk and organic matter loss.
Grazing pastures	Low	Low	Grazing alone is ineffective, but when combined with spray-grazing, spray-topping or slashing it can provide adequate control.
Chaff cart	High**	High <sup>^^</sup>	Some logistical issues at harvest. Well suited to farms with livestock enterprises, where livestock can feed on chaff residues.
Narrow windrow burning	High**	Low	Risk of fire escaping windrows, some loss of nutrients. Requires additional work during autumn (e.g. burning and managing windrows). Success can be compromised if stubble is grazed over summer.
Harrington Seed Destructor (HSD) and Integrated Harrington Seed Destructor (iHSD)	High**	High	Loss of harvester capacity due to horsepower requirements (iHSD). On-going cost and maintenance (HSD). One-pass convenience.

Source: Adapted from a table compiled by Andy Bates, Bates Agricultural Consulting

\* If weeds have emerged at time of cultivation.

\*\* If seeds can be captured.

<sup>^</sup> Low cost on a per hectare basis.

<sup>^^</sup> High initial investment, but ongoing costs are low.



**ABOVE:** Collect weed seeds at harvest for subsequent destruction through burning or devices such as the Harrington Seed Destructor. Photo: Sam Trengove, Trengove Consulting

**LEFT:** Grazing is most effective when combined with other non-chemical and chemical control methods. Photo: Catriona Nicholls



### Stubble burning

Research from WA by Michael Walsh and Peter Newman (Australian Herbicide Resistance Initiative) determined the temperature and duration required to destroy weed seeds of annual ryegrass are  $>400^{\circ}\text{C}$  for at least 10 seconds and  $>500^{\circ}\text{C}$  for at least 10 seconds for wild radish. Temperatures for other weed species are yet to be determined, but are likely to be similar. These temperatures can be achieved in a whole-paddock burn if cereal stubble loads are  $>4\text{t/ha}$ .

In low-rainfall cropping regions, stubble loads are often  $2\text{t/ha}$  or less, making stubble burning an ineffective strategy for controlling weeds. Stubble burning also substantially increases the risk of wind erosion.

Narrow windrow burning after harvest is a far better option in low-rainfall cropping regions to control weeds and protect soils.

### Grazing pastures

Grazing pasture in itself is generally ineffective in controlling weeds unless combined with slashing, cultivation and/or spray-topping or spray grazing, where weed control can be up to 95 per cent for many common weeds.

### Harvest weed seed management

Collecting and destroying weed seeds at, or soon after, harvest is gaining popularity among growers as an effective non-chemical control measure, particularly for annual ryegrass. Seed retained in the head of many annual weeds can be collected by the harvester if the crop is harvested low ( $<15\text{cm}$ ). Most of these weed seeds are then present in the chaff fraction of the harvest residue. This chaff fraction (containing the weed seeds) can then be destroyed by burning (narrow windrow, chaff pile) or with a seed destruction device attached to the harvester (e.g. Harrington Seed Destructor). This technique is less suited to weeds that mature rapidly and shed a portion of their seed before harvest (e.g. brome grass).

However, as outlined in the Australian Herbicide Resistance Initiative publications — *Harvest Weed Seed Control* — the most troublesome annual weed species of Australian cropping systems produce mature seed on upright plant structures at the time of harvesting wheat. Annual ryegrass, wild radish and wild oats all retain high proportions ( $\geq 70$  per cent) of total seed production above harvest cutting height ( $15\text{cm}$ ) at the commencement of the wheat harvest.

### Further information

- The GRDC Integrated Weed Management Hub: <https://grdc.com.au/Resources/IWMhub>
- The Effectiveness of On-farm Methods of Weed Seed Collection at Harvest Time: <http://www.grdc.com.au/CaseStudy-WeedSeedHarvest-Albany>
- Harvest Weed Seed Control: [http://www.weedsmart.org.au/wp-content/uploads/2013/12/AHRI-Harvest-Weed-Seed-Control-Booklet\\_2013-version.pdf](http://www.weedsmart.org.au/wp-content/uploads/2013/12/AHRI-Harvest-Weed-Seed-Control-Booklet_2013-version.pdf)
- Narrow windrow burning (Grassroots Agronomy): <http://www.grassrootsag.com.au/assets/nwb2.pdf>
- Integrated Harrington Seed Destructor: <http://www.ihsd.com/>