

SECTION 6

Weed control

Weeds compete with soybeans for moisture, nutrients and light. Weed contamination of the crop can drastically reduce grain yield and increase harvest costs from mechanical complications and blockages. Further costs may be incurred if weed seeds have to be graded out of the harvested grain.

Soybeans are most sensitive to weed competition four to seven weeks after emergence. Extreme grass competition can affect soybean yields much earlier, especially if conditions are dry. Tall growing weeds (Apple of Peru, gooseberries) that push through the crop canopy can shade the crop, causing leaf fall and straggly, weak-stemmed plants with low pod counts. Under cool, humid conditions these crops are more subject to sclerotinia.

Barnyard grass (*Echinochloa* spp.), Bathurst burr (*Xanthium spinosum*), blackberry nightshade (*Solanum nigrum*) and bladder ketmia (*Hibiscus trinom*) are present in most irrigation and dryland areas and will vigorously compete with the soybean crop. Additionally, Bathurst burr and blackberry nightshade are seed quality contaminants.

Uncontrolled growth of troublesome weeds such as apple of Peru (*Nicandra physalodes*), jute (*Corchorus* spp.) and sesbania pea (*Sesbania cannabina*) can even prevent harvesting because of their tall growth habit.

Vines, typically from the Convolvulus family (bellvine *Ipomoea plebia*), are commonly major problems in coastal soybeans grown in cane farming rotations because of weed competition effects and their vigorous twining habit which may prevent harvesting of the mature soybean crop.

Adverse effects of weeds on soybean yield are determined by:

- Weed – species, growth habit, density and duration of competition;
- Crop – vigour, density and planting configuration.

Weed control starts with an Integrated Weed Management (IWM) program to manage the weed seed bank in the soil.

Since no single herbicide or management option will control all weeds, growers should be conscious of the importance of crop rotations. For example, rotation with maize allows the use of a range of herbicides to control problem broadleaf weeds of soybean crops.

Ideally, always try to control weeds before planting. Pre-plant application of knockdown sprays using glyphosate is safe, cheap and effective, and helps the soybean crop get a rapid start.¹

A well-managed, weed-free fallow is the first step essential for good weed management in any field cropping activities. With conventional cultivation a weed-free seedbed is best achieved with an early working and follow-up cultivations to help kill weeds and remove new seedlings. Full cultivation is falling out of favour in many areas as it doesn't align with soil and moisture conservation philosophies. The widespread availability, adoption and price reduction of autosteer GPS across much of the grains industry has meant that more growers are adopting reduced tillage systems. In no-till and reduced till crops, herbicide sprays are used as alternatives to cultivations.

¹ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

The development of a dense canopy will assist in reducing the effect of weeds germinating later in the season. However, do not think this alone will compensate for poor (or absent) weed management. Establishing a uniform, robust plant stand at the targeted plant population is an important step in minimising gappy crops, which allow weeds to flourish. Sowing too deep, into compacted, crusted or waterlogged soil are all factors that can reduce establishment and increase weed competition. Early canopy closure is best achieved by sowing in narrower rows, however this will not suit many farming systems in rotation with other row crops like cotton, maize and sugarcane. Wide rows allow inter-row cultivation and low cost band spraying of rows.²

6.1 Pre-emergent herbicides

An important point for effective herbicide use and getting the most out of herbicides (Table 1) depends on several factors:

- It is much easier, cheaper and more effective to control weeds when they are small.
- As a general rule, ground rig application is more effective than aerial application because of better coverage.
- Read the herbicide label carefully for details on optimum application methods, optimum conditions for spraying and the appropriate Personal Protective Equipment (PPE) required to safely mix, load and apply the product(s).
- Be aware that weeds can become resistant to herbicides if they are not used as recommended. Practice good crop rotations, rotate herbicide groups and combine chemical and non-chemical weed control methods to reduce the chance of weeds developing resistance.

Under conventional cultivation with a fine seedbed, grass weeds may be economically controlled with pre-emergent herbicides like trifluralin (Triflur[®]) and pendimethalin (Stomp[®]). These products are soil incorporated and need a good seedbed free from large clods (grass seeds inside clods can germinate, establish and survive after rain 'melts' clods). Metolachlor products like Dual Gold[®] are best surface applied immediately post planting. Like trifluralin and pendimethalin, metolachlor has very limited activity on many broadleaf weeds.

Metribuzin is another pre-emergent herbicide that has primarily broadleaf activity, however there are very strict caveats regarding the use of this product – refer to the label. Some growers have also had success with flumetsulam (Broadstrike[®]) when applied as a pre-emergent herbicide for a small range of broadleaf weeds. It is commonly mixed with pendimethalin.³

6.1.1 Grasses

- A range of selective herbicides available that will control grasses within soybeans.
- Generally a large window of opportunity to control post emergent grasses however early spraying is cheapest and most effective.
- Most are Group A herbicides which are all lethal to all other grass crops (maize, sugarcane, etc). Beware of spray drift and keep a spray diary, noting wind speed and direction.
- Some are very expensive and have long withholding periods.
- Some growers have had success using paraquat/diquat mixes under shielded sprayers.
- Interrow cultivation may also be possible with Lilliston type cultivators, finger rakes, etc., however this will not suit the philosophy of zero tillage systems.⁴

² Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

³ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

⁴ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

6.1.2 Broadleaf

- Limited number of products.
- Very small window of opportunity for post-emergent broadleaf control.
- Expensive and only effective on very small weeds. Cannot be used as a salvage spray.
- Bad vine and broadleaf infestations usually spell disaster for a grain crop.
- Spinnaker has a very long plant back period for other crops – read the label.⁵



Figure 1: Bathurst burr. (Photo: DAFF Qld website)

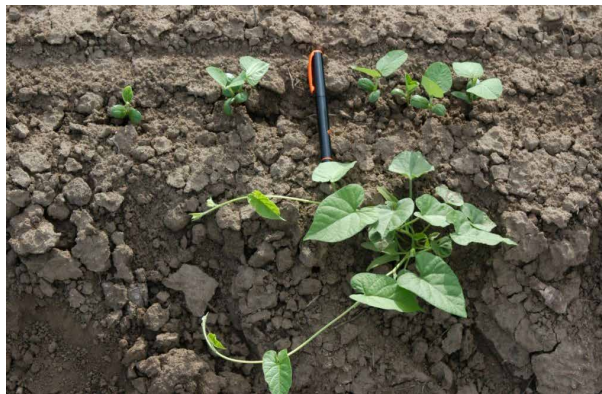


Figure 2: Convolvulus – bellvine. (Photo: DAFF Qld website)



Figure 3: Sesbania seedling showing juvenile and adult leaf forms. (Photo: DAFF Qld website)

⁵ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

Table 1: Herbicides registered for weed control in soybeans

Situation	Weed	Active ingredient	Product example	Rate	Withholding period (WHP)
Pre-plant	Grasses and some broadleaf	Trifluralin ¹	Triflur [®] 480g/L	1.2-2.3 L/ha	Nil
		Pendimethalin ¹	Stomp Aqua [®]	1.8- 2.2 L/ha	Nil
		Metolachlor ²	Dual gold [®]	1.0-2.0 L/ha	Nil
Post-plant Pre -emergent	Grasses and some broadleaf	Imazethapyr ²	Spinnaker [®] 700WDG	100-140 g/ha	Nil
		Flumetsulam	Broadstrike	25 or 50 g/ha	Nil but 4 weeks for grazing
		Metolachlor ²	Dual Gold [®]	1.0-2.0 L/ha	Nil
Post-emergent	Broadleaf and grasses	Imazethapyr	Spinnaker [®] 700WDG	100-140 g/ha plus wetter	Nil
	Broadleaf and grasses	Imazamox	Raptor [®]	50 g/ha plus wetter	Nil but 4 weeks for grazing
	Grasses	Butroxydim	Factor WG [®]	120-180 g/ha plus oil	Nil but 14 days for grazing
	Grasses	Clethodim	Select [®] 240g/L	250-500 mL/ha depending on weed growth stage (i.e. 250-375 for 2-5 leaf, 375-500 for >5 leaf)	Nil for harvest, 21 days for grazing
	Grasses	Fluazifop	Fusilade Forte [®]	0.82-1.65 L/ha plus wetter	17 weeks and 7 weeks for grazing
	Grasses	Haloxyfop	Verdict [®] 520	100-150 mL/ha plus wetter	Nil and 28 days for grazing
	Grasses	Quizalofop	Targa [®]	250-1000 mL/ha plus wetter/oil	Nil and 28 days for grazing
	Grasses	Sethoxydim	Sertin [®]	1.0 L/ha plus oil	Nil and 21 days for grazing
	Broadleaf ³	Acifluorfen ⁴	Blazer	1.0 – 2.0 L/ha	Nil
Broadleaf ³	Bentazone	Basagran [®]	1.5-2.0 L/ha	8 weeks	

1 Should be thoroughly incorporated prior to planting (recent mill mud applications or high trash levels will substantially reduce efficacy)

2 This product requires rain/irrigation to activate the chemical. No WHP for harvest. Do not graze or cut for stock food for 13 weeks after application.

3 Broadleaf weeds should be very small (up to 4 leaf stage, and up to 8 leaf stage for some broadleaf weeds)

4 Blazer can cause severe leaf burn in soybeans, consult your agronomist before use

Note the very long withholding period (WHP) of some of the herbicides (Fusilade, Targa, Basagran).

For specific rates and information – always refer to the label instructions provided by the supplier.

Ensure you investigate all chemicals before use as some have significant plant back periods for other crops that you may be using in rotation.⁶

⁶ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy-australia/Soybean_Production

6.2 Post-plant pre-emergent herbicides

Some broadleaf weeds, nut grass and barnyard grass may be controlled with a pre-emergent application of Spinnaker® 700 herbicide, surface applied immediately post planting. For best results, Spinnaker® also requires a fine seedbed and rainfall for incorporation. This product may also be used very effectively as a post emergent spray.

6.3 In-crop herbicides: knock downs and residuals

Ideally all weeds should be controlled when small to limit any opportunities to compete with the young soybean crop.

Grasses and broadleaf weeds can be controlled post-emergence, preferably as early as possible after the weed emergence. The window to control broadleaf weeds is very small and best results are obtained on weeds less than four leaf stage. A delayed spray may result in greater yield loss because of the herbicide will not achieve a suitable kill of the rapidly growing weed at label rates.

Post-emergent broadleaf weeds (Table 2) may be controlled with Spinnaker®, Broadstrike®, Basagran®, Blazer® and Raptor®. Mixtures of Basagran® and Blazer® are commonly used to increase the spectrum of activity.

Basagran® and Blazer® are best sprayed early in the morning with high humidity. Note that Blazer® will commonly cause severe phytotoxicity (leaf burning) the day following spraying, however this effect is transitory and has no impact on yield. This effect is worse when humidity is low. Blazer® is the only product that will take leguminous weeds (*Sesbania*, etc) out of soybeans.

For broadleaf weed control, Spinnaker® can be broadcast sprayed immediately post sowing or post crop emergence over small weeds in the 2-4 leaf stage. For best results, add Liase and recommended spray adjuvants. Note that Spinnaker has very long (up to 27 months) recropping intervals for some rotational crops – always check the label prior to use. Raptor is another option with a shorter plant back period to Spinnaker.

Table 2: Post-emergent broadleaf herbicides registered for weed control in soybeans. For specific information – always refer to the product label*

*Suppression

Weed	Basagran®	Spinnaker®	Blazer®	Raptor®	Broadstrike®
Amaranthus			R + wetter	R + wetter	
Annual ground cherry	R		R + wetter		S* + wetter
Anoda weed	R	R + wetter		R + wetter	S* + wetter
Apple of Peru	R	R + wetter	R + wetter		
Bathurst burr	S*	R + wetter			
Bellvine	R	R + wetter	R + wetter	R + wetter	
Blackberry nightshade	S*		R + wetter	R + wetter	
Bladder ketmia			R + wetter		S* + wetter post-emerg weed
Caltrop				R + wetter	S* up to 4 leaf
Fat hen		R + wetter		R + wetter	R +wetter
Jute		R + wetter	R + wetter		
Mintweed					
Mustard				R + wetter	
Nogoora burr	R		R + wetter	R + wetter	
Pigweed (red)			R + wetter		S* +wetter
Pigweed (black)			R + wetter		S*
Sesbania pea			R + wetter		

Weed	Basagran®	Spinnaker®	Blazer®	Raptor®	Broadstrike®
Thorn apple	R	R + wetter	R + wetter	R + wetter Only fierce thornapple, not common thornapple	S* +wetter, only fierce thornapple Qld only, not common thornapple
Wild turnip				R + wetter	
Wild gooseberry		R + wetter	R + wetter	R + wetter	S* +wetter
Wireweed				R + wetter	

Post-emergent grass herbicides are most effective on actively growing grasses at the three to five leaf stage before tillering commences, however they have a far wider application window than the post emergent broadleaf herbicides and can still be used effectively on quite large grasses. Always read and follow the label exactly for best results and use recommended spray adjuvants.⁷

6.4 Integrated Weed Management (IWM)

The principle of Integrated Weed management (IWM) is that crop weeds are managed most effectively using a combination of chemical and non-chemical methods. Good weed management relies on crop rotations and specific management strategies targeted at reducing the seed banks of problem weeds.

To manage weeds efficiently:

- Plan weed management strategies and control weeds before planting.
- Select crop, planting rate and inter-row cultivation to reduce reliance on chemicals where appropriate.
- Identify weeds and understand their biology before applying herbicides.
- Always refer to the herbicide manufacturer's product label before use.
- Apply herbicides at the right time and at the right rate.
- Use effective application equipment.
- Keep accurate records.
- Ensure herbicide modes of action are rotated each season.

An important approach of IWM is to look at the farm as a system and to control weeds before you plant.⁸

6.5 Weed control in organic soybeans

There is no comprehensive 'recipe' for weed control in organic crops. Organic methods used to control weeds do not include the use of synthetic herbicides. Weed control systems must be developed to suit the particular weed spectrum, cropping rotation sequence and farming system, cost structure and so on.

In conventional and organic agriculture there is no substitute for the time-honoured practice of controlling crop weeds in the fallow to reduce the weed seed bank as well as in-crop. This reduces the overall weed seed burden, reducing the need for in-crop weed control methods such as inter-row cultivation, and hand weeding. Increasing crop competition, by increasing the planting rate can assist minimising weed growth, however cannot be relied on as a sole control measure.

When budgeting for organic crops, don't overlook the cost of hand weeding, an essential ingredient not only for the current crop but also for the future success of the organic

⁷ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

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farming system. Organic growers need to use inter-row cultivation to control weeds, but will often have to employ a team of chippers to remove weeds in the plant row.

Alternative non-chemical weed controls such as flame, hot water and steam treatments are not yet fully developed for wide usage. However, development work continues and such techniques are expected to become more effective and economic in the near future.⁹

6.6 Harvest-aid herbicides – desiccating the crop

Herbicides are commonly applied to soybean and other pulse crops as harvest aids to ensure that a uniform, dry and predominately leaf free crop is presented to the header. Herbicides are also used to desiccate green weeds, which are likely to cause harvesting difficulties. These difficulties include mechanical blockages in the header, grain quality downgrading from contamination by declared weed seeds and from staining of the harvested grain by the weed sap. Desiccants are also applied for crops that display uneven maturity.¹⁰

The two options available to growers are:

- Diquat (Reglone®) is applied when 80% of pods are yellow/brown and seeds are ripe, yellow and pliable. Harvest 4–7 days after spraying.
- Weedmaster Argo or Weedmaster DST is applied only after seed pods have lost all green coloration and 80%–90% of leaves have dropped. Do not apply to crops grown for seed or sprouting. Do not harvest within seven days of application.

See also [GrowNotes Soybeans, Section 12, Harvest](#).

⁹ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production

¹⁰ Australian Oilseeds Federation (2013), Better Soybeans manual http://www.australianoilseeds.com/soy_australia/Soybean_Production