

MORE INFORMATION

GRDC 'Fact Sheet Pre-harvest Herbicide Use': www.grdc.com.au/GRDC-FS-PreHarvestHerbicide

GRDC 'Fact Sheet Late Season Herbicide Use': <http://elibrary.grdc.com.au/ark%21%2133517/x4vcv2x/wk5myft>

DPIRD 'Fact Sheet Weed Control in Mature Crops and Desiccation': https://www.agric.wa.gov.au/grains/crop-weeds-stop-weed-seed-set?page=0%2C5#smartpaging_toc_p5_s4_h3

DPIRD 'Crop Weeds': https://www.agric.wa.gov.au/grains/crop-weeds-stop-weed-seed-set?page=0%2C3#smartpaging_toc_p3_s1_h3

Pulse Australia 'Australian Pulse Bulletin —Desiccation and Crop-topping in Pulses': <http://www.pulseaus.com.au/growing-pulses/publications/desiccation-and-croptopping>

Desiccation, crop-topping and green/brown manuring

9.1 Overview

Desiccation and crop-topping involve strategic application of a registered herbicide close to the final maturity of the lupin crop. These tactics can be used separately or in combination to meet different objectives on individual properties.

Desiccation (typically coupled with windrowing/swathing) terminates crop growth, regardless of the development stage of weeds. The aim is to encourage even ripening of crops and minimal infestations of green weeds for ease of harvest.

Desiccation is often not warranted in southern region narrow leafed lupin crops because these naturally tend to ripen rapidly and evenly and there can be little to be gained by applying a desiccant. But it may be required in manganese (Mn) deficient crops that do not ripen, or where weeds have become a harvest problem.

Desiccation can be an effective strategy in albus lupin crops in some areas and some seasons to dry out wild radish (*Raphanus raphanistrum* L.) seed prior to harvest and to prevent harvest delays.

Crop-topping is the application of a non-selective knockdown herbicide close to crop maturity aimed at preventing seed set in weeds (mainly grasses), controlling in-crop weed escapees and lowering paddock weed seedbanks.

This approach broadens weed management options and strengthens the role of lupin and other pulses in crop rotations for southern region farming systems.

For crop-topping, timing is critical and best results are achieved when it is matched to weed seed development stage – irrespective of the development stage of the crop.

Narrow leafed lupin can suffer substantial yield losses if the crop has not reached physiological maturity at or before the timing of crop-topping.

Breeding and variety development by Pulse Breeding Australia (PBA) has produced earlier maturing narrow leafed varieties, such as PBA Bateman[®], PBA Jurien[®], PBA Barlock[®] and PBA Gunyidi[®], that are far better suited to this system than older varieties.

Typically, albus lupin mature too late for crop-topping to be effective and desiccation is rarely needed to even-up ripening of these varieties.¹

As with all herbicide use, the GRDC advises strict adherence to product label registrations, rates and withholding periods when undertaking desiccation or crop-topping in the lupin crop.

Harvest can start as soon as the harvest withholding period has been observed.

Late season herbicide application increases the risks of detectable herbicide residues in harvested grain and it is important to know the maximum residue limits (MRL) for lupin.

It is recommended to harvest crop-topped lupin as soon as possible (mindful of any withholding periods) if weed seed capture is an objective.

¹ Pulse Australia (2016) Australian Pulse Bulletin, Desiccation and Crop-topping in Pulses, <http://www.pulseaus.com.au/growing-pulses/publications/desiccation-and-croptopping>

FEEDBACK

Crop-topping increases the speed that weeds die-off and drop their seeds on the ground, making capture in chaff carts, bales of straw, windrows or with seed destruction technology important.

It is advised to test vigour and germination of lupin seed from crop-topped paddocks for planting the following year, or avoid using this seed altogether.

Using lupin crops for green or brown manuring can be another strategy for reducing weed burdens in cropping systems, with added benefits of improving soil fertility and soil organic matter.

But there are significant risks of wind and water erosion from green manuring that require close consideration.

9.2 Windrowing/swathing



Figure 1: Pictures show the pod and seed development of narrow leaved lupin, and embryos from those pods, at various stages in their development. The coloured bars show changes in the colours of the pod, seed and embryo.

(SOURCE: DPIRD)

Windrowing, or swathing, of lupin involves cutting the crop and laying it in a windrow. It is carried out when the seed is close to physiological maturity, before desiccation, to help manage risks of grain shattering and spoilage.

This tactic is suitable for narrow leaved and albus types and also provides benefits of: avoiding grain contamination with green material (such as late germinating weeds); reducing potential grain storage problems (due to high moisture levels in weed seeds); helping to manage crops that are ripening unevenly; and reducing weed seed set as part of a harvest weed seed control program.

Timing the windrowing operation is vital to its success and is based on an assessment of seed maturity in the order of pods (primary to final). This involves checking the cotyledon (kernel) colour, which will often be green for seeds found in pods on the lateral branches and yellow for those found on the main stem.

Typically, windrowing of lupin crops can start when the average moisture content of all seed is 65 percent. This tends to occur at the start of leaf drop, when the stems and leaves of the plant are light green-yellow.

It is recommended to avoid windrowing if seed moisture content falls below 50 percent, as the risk of yield loss through pod drop during the operation and while the crop is in the windrow increases. It is advised to cut the crop 10-20 cm above the ground.

FEEDBACK

Windrows will typically be ready to harvest about 10-30 days after cutting. Harvester settings are important to minimise potential yield loss from pod drop or shattering.

For albus lupin varieties, it is important to avoid windrowing too early, as immature seeds can shrivel when dry and lead to lower grain quality. For narrow leaved varieties, it is advised to avoid cutting crops if there are prolonged dry conditions at harvest, as this can cause higher levels of pod drop. See Chapter 10 for more information about harvesting lupin crops.



Figure 2: Pod wall, seed coat and cotyledon colour of narrow leaved lupin at the correct stage of maturity to windrow.

(SOURCE: NSWAg Pulse Point)

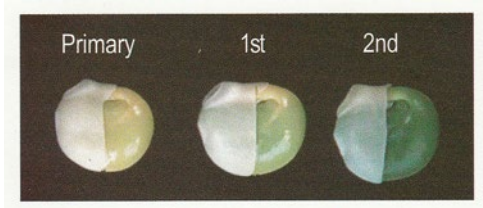


Figure 3: Seed coat and cotyledon colour of albus lupin at the earliest stage at which they should be windrowed.

(SOURCE: NSWAg Pulse Point)

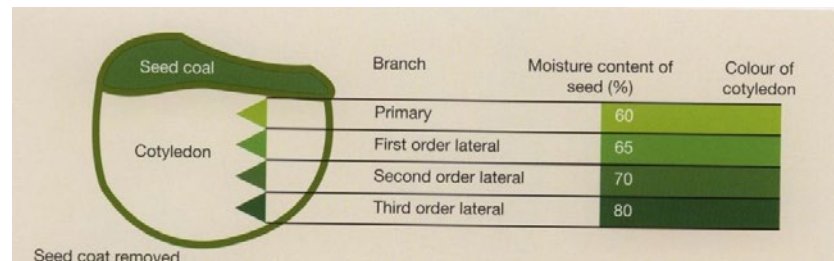


Figure 4: Summary of lupin growth stage and when to undertake windrowing.

(SOURCE: DPIRD)

9.3 Decision-making for desiccation (with windrowing/swathing)

Crop desiccation and windrowing/swathing are predominantly harvest aids. But this practice can provide significant weed management benefits in some conditions and seasons, especially by lowering the weed seedbank.²

The main reasons for using desiccation, with windrowing/swathing, in lupin crops include:

- » Accelerating or evening-up crop ripening for ease of harvesting
- » Improving harvest speed and efficiency
- » Minimising grain loss from shattering or lodging in prone areas
- » Improving grain quality
- » Reducing risks of weather damage
- » Conserving soil moisture for the next crops
- » Stopping seed set in late season weeds
- » Preventing seed set of annual ryegrass (*Lolium rigidum*)
- » Helping manage any herbicide resistance issues.³

9.4 Decision-making for crop-topping

Crop-topping can be a valuable tool to reduce the weed seedbank to enable early dry sowing in a low weed burden paddock the following year, rather than waiting for sufficient rain to germinate weeds for a knockdown herbicide application.

Crop-topping in lupin helps manage weeds, especially grasses, that are often difficult to control in cereal and canola crops and is a useful part of a longer-term herbicide resistance management plan.

Key reasons for crop-topping lupin crops in the southern region include to:

- » Minimise production of viable weed seeds (especially annual ryegrass)
- » Optimise grain yields
- » Even-up crop maturity
- » Help manage any herbicide resistance issues.⁴

2 DPIRD (2016) Crop Weeds: Stop weed seed set, In-crop Weed Management for Seed Set Control, https://www.agric.wa.gov.au/grains/crop-weeds-stop-weed-seed-set?page=0%2C5#smartpaging_toc_p5_s4_h3

3 DPIRD (2016) Crop Weeds: Stop weed seed set, In-crop Weed Management for Seed Set Control, https://www.agric.wa.gov.au/grains/crop-weeds-stop-weed-seed-set?page=0%2C5#smartpaging_toc_p5_s4_h3

4 DPIRD (2016) Crop Topping Pulse Crops, <https://www.agric.wa.gov.au/lupins/crop-topping-pulse-crops>

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GRDC 'Fact Sheet Pre-harvest Herbicide Use': www.grdc.com.au/GRDC-FS-PreHarvestHerbicide

DPIRD 'Crop-topping Pulse Crops': <https://www.agric.wa.gov.au/lupins/crop-topping-pulse-crops>

Australian Pesticides and Veterinary Medicines Authority: www.apvma.gov.au

9.5 Products and timing for crop-topping and desiccation

Crop-topping lupin with paraquat (Group L) can be effective to control annual ryegrass in conducive seasons.

This is an accepted practice in many parts of the southern region to help control high annual ryegrass burdens in preparation for potentially dry sowing wheat crops the following year.

Crop-topping is best carried out when lupin plants have lost 80-90 percent of leaves (including all brown leaves still attached to the plant) and grass weed species are at the 'flowering' to 'soft dough' stage. Early maturing narrow leafed varieties, including PBA Bateman⁵, PBA Jurien⁶, PBA Barlock⁶, PBA Gunyidi⁶ and Mandelup⁶, tend to reach this stage seven to 10 days before later maturing, older lines, such as Tanjil⁵.

Diquat (Group L) is registered for desiccation in lupin crops in the southern region.

It is recommended desiccation or crop-topping tactics are carried out as part of an integrated weed management (IWM) program that might also include cutting crops for hay, green or brown manuring and harvest weed seed control (HWSC) tactics.

Typically, narrow leafed lupin crops in low to medium rainfall areas tend to ripen quickly and evenly and often desiccation is not warranted.

Success of desiccation and crop-topping relies on seasonal conditions, especially in high rainfall areas.

If there is a prolonged wet spring, this will tend to extend lupin flowering and podding and annual ryegrass can often develop too quickly (past the ideal stage) before the crop is ready to treat with herbicides.

Desiccation should be avoided, or held off, if heavy rain is forecast soon after spraying – as yield loss can be significant due to weakened pods.

It is recommended to harvest promptly when lupin grain reaches more than 14 percent moisture to minimise crop losses.

Guidelines for assessing annual ryegrass development stage for desiccation and crop-topping includes:

- » Pull seed off from the middle of the seed head
- » Squeeze the seed between your fingers
- » If there is just sappy liquid – the seed is 'watery ripe'
- » If there is milky, white liquid – this is the 'milk stage'
- » Sap thickness denotes early, middle and late milk stages
- » If there is sap that is sludgy but still soft and like dough – this is the 'dough stage'
- » When there is very limited moisture – this is the 'firm or hard dough stage'
- » If the seed hardly compresses and is a yellow/brown color – this is near 'ripening'
- » After this, it will be too late to get good control.⁶

Research has shown that the yields of lupin and other pulse crops are typically not reduced if crop-topping is delayed until seeds in the top pods of lupin are 75 percent or more of full size.⁷

But there may need to be a balance between optimal timing for effective annual ryegrass control (which is often earlier) and potential lupin grain yield loss.

5 DPIRD (2016) Crop Topping Pulse Crops, <https://www.agric.wa.gov.au/lupins/crop-topping-pulse-crops>

6 DPIRD (2016) Crop Topping Pulse Crops, <https://www.agric.wa.gov.au/lupins/crop-topping-pulse-crops>

7 GRDC (2015) Fact Sheet – Pre-harvest Herbicide Use, www.grdc.com.au/GRDC-FS-PreHarvestHerbicide

FEEDBACK

It is advised not to desiccate or crop-top lupin that will have seed retained for subsequent planting, as this has potential to adversely affect seed quality due to uneven ripening.⁸

9.5.1 Paraquat use

Paraquat has been found to work well when integrated in cropping systems in the southern region, as it has a wider application window for timing of crop-topping to control annual ryegrass. Another benefit is that it will typically hasten the time to harvest.

For application to control annual ryegrass, the last seed heads at the bottom of the plant can be emerged and most heads should be at – or just past – flowering (not yet haying-off).

Crop-topping with paraquat has been shown to significantly reduce the number of annual ryegrass plants emerging in the following wheat crop.

Guidelines for using paraquat (at 250 grams/Litre) on lupin crops for crop-topping include:

- » Rates of 400–800 millilitres per hectare
- » Use highest registered rate
- » Spray volume of 30–100 L water/ha
- » Aim for medium droplets
- » Annual ryegrass seeds heads should be emerged and at, or just past, flowering and not yet haying-off
- » Harvest withholding period is seven days after application
- » Harvest as soon as practicable once grain is at 14 percent moisture.⁹

9.5.2 Diquat use

Diquat is useful for desiccation of lupin crops and registered for use as soon as the crop has reached full maturity.

It can accelerate crop drying and reduce seed moisture levels to reduce grain drying costs, risks of harvesting delays and weather risks at this time of year.

Guidelines for using diquat (at 200 g/L) on lupin crops for desiccation include:

- » Rates of 2-3 L/ha
- » Application by boomspray, hand lead or aeroplane
- » Minimum spray volume of 100 L/ha recommended for ground application
- » Spray volume of 30–60 L/ha recommended for aerial application
- » Aim for fine-medium spray quality
- » Flat fan nozzle is preferred on ground
- » Aim to minimise drift from any aerial application
- » Apply when crop has reached full maturity
- » No specified withholding period.¹⁰

8 DPIRD (2016) Crop Topping Pulse Crops, <https://www.agric.wa.gov.au/lupins/crop-topping-pulse-crops>

9 Pulse Australia (2016) Australian Pulse Bulletin, Desiccation and Crop-topping in Pulses, <http://www.pulseaus.com.au/growing-pulses/publications/desiccation-and-croptopping>

10 Pulse Australia (2016) Australian Pulse Bulletin, Desiccation and Crop-topping in Pulses, <http://www.pulseaus.com.au/growing-pulses/publications/desiccation-and-croptopping>

MORE INFORMATION

DPIRD 'Green Manuring':
https://www.agric.wa.gov.au/grains/crop-weeds-stop-weed-seed-set?page=0%2C3#smartpaging_toc_p3_s1_h3

DPIRD 'Carbon Farming Fact Sheet Green and Brown Manuring':
<https://www.agric.wa.gov.au/carbon-farming/carbon-farming-fact-sheet-green-and-brown-manuring>

GRDC 'Fact Sheet – Manuring of Pulse Crops': <https://grdc.com.au/Resources/Factsheets/2013/09/Manuring-of-Pulse-Crops>

DPIRD 'Brown Manuring':
https://www.agric.wa.gov.au/grains/crop-weeds-stop-weed-seed-set?page=0%2C3#smartpaging_toc_p3_s1_h3

9.6 Green manuring of lupin

This tactic involves growing a crop for the specific purpose of turning it into the soil when green in spring, using cultivation, with the aim of boosting soil organic matter content and reducing weed burdens.

Green manuring is not commonly used in the southern region and a significant risk of wind and water erosion is associated with this practice that requires close consideration.

The green manuring process requires good management and timing of cultivation and depends on seasonal conditions.

9.7 Brown manuring of lupin

Brown manuring (BM) is a 'no-till' version of green manuring that uses a non-selective herbicide to desiccate the crop (and weeds) at flowering.

It is rarely practiced in the southern region due to high risks of water and wind erosion.

Brown manuring means crop plant residues remain standing, which can be a preferred option in some areas to green manuring – especially on lighter soils that are prone to erosion.

Research in the southern region found a crop production system that included BM of legumes in the rotation could be as profitable as continuous cropping.¹¹

In practice, the preferred option for any legume crop used for BM in the southern region tends to be vetch due to its versatility for a range of soil types.¹²

11 Patterson, R.A (2014) GRDC Grains Research Update Paper 'Brown manure as a farm risk strategy', <https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/02/Brown-manure-as-a-farm-risk-strategy-a-whole-farm-perspective>

12 Patterson, R.A (2014) GRDC Grains Research Update Paper 'Brown manure as a farm risk strategy', <https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/02/Brown-manure-as-a-farm-risk-strategy-a-whole-farm-perspective>