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GRAINS RESEARCH
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CORPORATION

VETCH

SECTION 11

LATE SEASON MANAGEMENT

KEY POINTS | FORAGE | MANURE | GRAIN AND SEED

Late season management

Key points

- Late season management is determined by end use
- Conservation as high-quality forage requires attention to detail – especially cutting and curing
- Timing of termination for manure crops relates to whether the objective is weed control or maximising biomass
- Correct timing of grain harvest is important to minimise grain damage through extra handling or grain loss due to pod shatter

FEEDBACK

IN FOCUS

Linking vetch management to end use is especially crucial in late season management. Usually vetch for forage will be cut first, followed by manure crops and finally vetch that is to be kept for seed. Timing of harvest will influence the amount of nitrogen fixed and the type of weeds that set seed.

Late season management varies depending on end use, with timing of harvest or vetch termination being the crucial factor to maximise each outcome.

MORE INFORMATION

Feed test laboratories in Australia, https://www.dairyaustralia.com.au/farm/feedbase-and-animal-nutrition/feed-management/feed-lab-testing

11.1 Forage

Vetch can be conserved as silage or hay, with silage cut and baled earlier as it can be conserved at higher moisture content than hay. Forage production is always a balancing act between maximising quality and dry matter, as well as minimising weather damage.

11.1.1 Timing of cutting

To maximise forage quality (crude protein, metabolisable energy and digestibility) vetch silage and hay should be cut in the late-flowering to small-pod stage. Dry matter yield increases with later cutting but quality decreases as the vetch grain fills (see Table 1).

If cutting hay as a means of controlling weeds, it is important to cut before weed seedset. Cutting earlier, for silage, is generally more effective for controlling weed seedset, provided there is follow-up herbicide to prevent seedset from post-cutting weed regrowth.

Unlike cereals, foliage and feed value of vetch is relatively unaffected by frost, so frosted vetch does not have to be cut for forage immediately to preserve forage quality. Frost can affect seed in the pods, which is a concern if growing for grain.[1]

Table 1: Change in forage quality, digestibility (D) and dry matter (DM) production at three cutting dates from trials of oat–legume hay at Wagga Wagga, NSW. Values are adjusted for an average legume content of 30% in all oat–legume mixtures and 90% legume in legume monocultures.

Forage	Cut 2 October		Cut 23 October		Cut 6 November	
	Dry matter (t/ha)	Digestibility (%)	Dry matter (M t/ha)	Digestibility	Dry matter (t/ha)	Digestibility
Oats/Purple vetch	8.45	71	15.17	64	11.00	54
Oats/Common vetch	6.96	72	13.27	61	13.37	56
Oats/field pea	9.48	74	14.68	66	12.71	59

Source: NSW DPI (2005) Yield and digestibility of legume and oat forages. Prime Facts 52, NSW DPI http://pandora.nla.gov.au/pan/53289/20051213-0000/primefact_52-final.pdf

1 P McIntosh, P Bowden (2015) Using pulses for forage. Pulse Australia http://www.pulseaus.com.au/growing-pulses/publications/using-pulses-forage

FEEDBACK

Photo 1: *Cutting time is a balance between maximising quality and dry matter production. If cutting hay to control weeds it is important to cut before weed seedset.*

Photo: Emma Leonard, AgriKnowHow

Vetch forage quality

Vetch hay and silage are an excellent, reliable and cost-effective protein source, especially for milk production. Vetch hay contains 12–20 g crude protein per kilogram and 8–11 MJ dry matter digestible energy.[2]

Vetch forage quality should be measured using an accredited feed testing service. Generally, vetch hay and silage quality and price are similar to clover or lucerne hay.

Conditioning helps dry pods and stems faster to minimise weather damage and loss of leaf during baling or ensiling. All these factors help maintain forage quality.

11.1.2 Forage-making equipment

Silage and hay-making require specialised equipment – a mower, usually with in-built conditioners, rake, baler and handling equipment.

A rule of thumb for cereal hay is that if less than 200 ha (4–5 t/ha crop) of hay is to be made, then using contractors is most cost-effective, but owning equipment can give peace of mind. This would be very similar for vetch hay.

One mower and one baler are required for about every 350–400 ha of hay, while a rake can generally service 1,000 ha. If varieties with a spread of maturities are grown, less machinery may be possible.[3]

Vetch can be cut with a rotary or flail slasher and with knife or disc cutters. However, in heavy stands of pure vetch these can become clogged with vine and generally their performance is inferior to a rotary or flail slasher.

The stems of vetch dry a little slower than leaves. Quality reduces if leaf is lost during baling, which can occur if the stems take too long to dry. Conditioning squashes and cracks the stems, allowing water to be released, which helps accelerate drying.[4]

If drying-down is difficult it may be preferable to ensile (haylage) but there is a risk of self-combustion if material is baled when moisture is too high.

2 PIRSA/GRDC (2010) Vetch: The Ute Guide. PIRSA/GRDC – https://grdc.com.au/vetch-the-ute-guide

3 Aexco (2016) Producing Quality Oat Hay http://aexco.com.au/producing-quality-oat-hay

4 P Mcintosh, P Bowden (2015) Using pulses for forage. Pulse Australia http://www.pulseaus.com.au/growing-pulses/publications/using-pulses-forage

FEEDBACK

MORE INFORMATION

Haystack fires spontaneous combustion, http://apo.org.au/system/files/57092/apo-nid57092-53771.htm

11.1.3 When to bale

Vetch hay should be baled at about 15–16% moisture. Suitable storage temperature depends on bale size and conformation (Table 2).

Moisture content cannot be judged from a single sample of drying hay. The following is a guide to the moisture content of the hay crop as it is drying:

- 30–40% – leaves begin to rustle. They do no give up moisture unless rubbed hard. Moisture easily shows in stems scratched with a fingernail or, not so easily, when twisted in the hands.
- 25–30% – the hay rustles. A bundle twisted in the hands will snap with difficulty; it will show no surplus moisture. Thick stems may show moisture if scraped or split open with a fingernail.
- 20–25% – the hay rustles readily. A bundle will snap easily if twisted; leaves may shatter and there are few moist stems.
- 15–20% – the hay factures easily. Bundles snap easily when twisted. It is difficult to see any moisture and the leaves shatter readily.

The ultimate test is to make a few bales and test with a moisture meter.

It is too wet to bale if:

- the crop wraps on moving parts of the baler
- the baler engine labours unduly
- the bales are too heavy
- the hay bale lacks spring
- there is a smear of moisture on the side of the bale.

High-moisture bales can result in the growth of mould, reducing quality and palatability, and may introduce toxins. They can also self-combust.

Hay baled at too low moisture shatters, the hay is dusty, there are too many leaf fragments, and the bales are too loose and light, even after tightening the bale chamber.

Finally, if the crop is too dry, e.g. 12–14% moisture content, it may be necessary to wait for the evening dew to bring the crop back up to 18–20% moisture content.[5]

Photo 2: *Vetch and vetch–oat mixes can retain a green colour but be sufficiently dry to bale. Use the scrunch test to estimate moisture content and use a moisture meter to test bale moisture content. Baling material too wet will result in degradation and can lead to self-combustion.*

Photo: Emma Leonard, AgriKnowHow

5 F Mickan (2013) Managing hay after it rains. AFIA http://www.afia.org.au/index.php/fodder-care/hay-factsheets/making-quality-hay/144-guide-to-moisture-content-of-hay

FEEDBACK

Table 2: Recommended moisture content for safe storage of various types of hay bales.

Bale type	Moisture content range (%)
Small rectangular bales	16–18
Round bales – soft centre	14–16
Round bales – hard centre	13–15
Large square bales	12–14
Export bales	<12

Source: Aexco (2016) Producing Quality Oat Hay http://aexco.com.au/producing-quality-oat-hay

11.1.4 Weather-damaged forage

Rain on cut forage can reduce quality prior to baling through:

- loss of colour – discolouration can indicate factors that affect the value of the hay or silage to end users
- stock feed value – palatability, digestibility and energy value can all be reduced by weather damage
- mould – the growth of mould in warm, moist conditions can adversely affect appearance and colour, palatability and feed value, and may make hay toxic to stock.

Silage quality can be severely affected if ensiled at high moisture, especially if air is not properly exhaled from the stack or bale.

Time of cutting, windrowing, tedding, conditioning, chopping and promptness of baling or ensiling at the correct moisture can help avoid adverse weather damage.

11.2 Manure

A green crop of vetch can be worked into the soil with cultivation equipment to boost organic matter content. More commonly, the vetch crop is brown manured by desiccating using a knockdown herbicide to kill both vetch and weeds, and allowing to decompose over the fallow period before being incorporated into the soil at sowing.

11.2.1 Time of termination

Timing of termination of a manure crop is determined by the objective of the manure crop:

- Weed control – timing is determined by the growth stage of the weed, not the vetch, and must be before weed seedset. This contrasts with crop-topping, where the timing is determined by the vetch to ensure grain has set (see Section 11.3.1 Harvest timing).
- Organic matter and nitrogen fixation – herbicide application will be later when the plants have reached peak biomass, at late flowering to early podding. The amount of nitrogen (N) fixed is directly linked to dry matter (DM) production – approximately 25 kg N per tonne of DM.[6]
- Conserving soil moisture for the following crop – usually a later termination than for weed control but still earlier than harvest, and timing will also be determined by in-crop rainfall.

MORE INFORMATION

GroundCover™ article, 'Brown manure legumes lower total crop risk, May–June 2015, https://grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-116-may-june-2015/brown-manure-legumes-lower-total-crop-risk

VIDEO

Brown Manure Vetch Termination, https://www.youtube.com/watch?v=TboLg-H3_I8

6 GRDC (2012) Inoculating legumes: a practical guide. GRDC https://grdc.com.au/GRDC-Booklet-InoculatingLegumes

FEEDBACK

Trials in the Mallee identified that in seasons with low spring and summer rainfall, early termination of vetch (3 months after sowing) can result in more nitrogen fixation. With more spring rain, greater biomass and nitrogen fixation will occur, so later termination would be better. Earlier termination may also be relevant in paddocks with subsoil constraints, which reduce vetches' ability to access deep soil moisture.[7]

There is a relationship between time of sowing and peak biomass production and this varies with species and variety. Sowing past the end of May reduced biomass production (Figures 1 and 2).

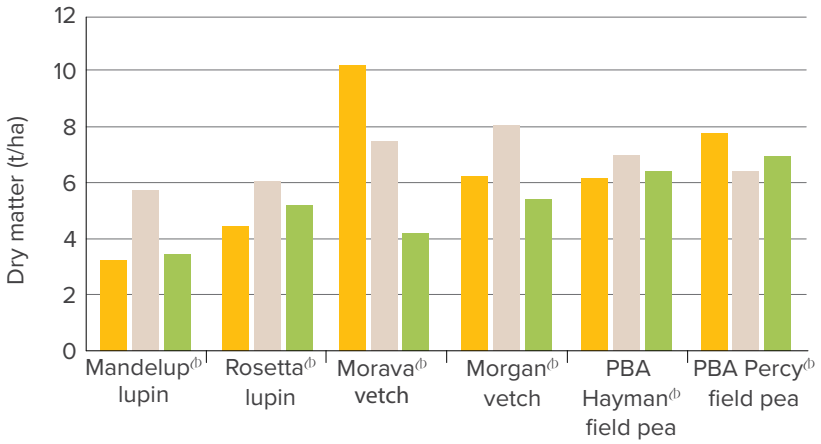

Figure 1: *Biomass production at the 'flat-pod' stage of lupin, vetch and field pea over three sowing dates at Wagga Wagga in 2012.*

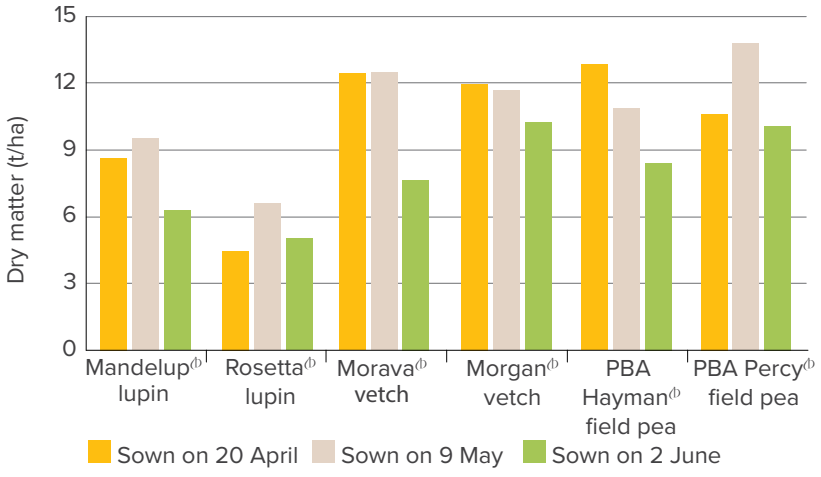

Figure 2: *Biomass production at maturity of lupin, vetch and field pea over three sowing dates at Wagga Wagga in 2012.*

Source (figures 1 and 2): GRDC Managing brown manure crops in southern NSW Fact Sheet. (2013) https://grdc.com.au/resources-and-publications/all-publications/factsheets/2013/09/manuring-of-pulse-crops

7 D Ferrier, H van Rees, L Watson, M Peoples (2013) Vetch termination influence on the following crop. BGC Season Research Results, www.farmtrials.com.au/view_attachment.php?trial_attachment_id=6267

FEEDBACK

Table 3: Vetch end-use termination treatment effect on pre and post-harvest soil nitrogen and water (0–120 cm).

2012 vetch termination treatment	2013 pre-sowing nitrogen (kg N/ha)	2013 pre-sowing soil water (mm)
Cultivated	66	57
Brown manure	85 $_{a}$	70
Grazed × 2	78 $_{a,b}$	67
Grain harvest	71 $_{a,b}$	54
Hay	44 $_{c}$	51
Sig. diff.	**0.004**	**NS**
LSD (P=0.05)	**17**	**–**
CV%	**15**	**32**

If the subscript letters between treatments are the same, they are not statistically different to one another. Where there are no significant differences between treatments, NS (not significant) is displayed. Different subscript letters between treatments denote significant differences. For example, 'Cultivated' is different to 'Brown manure' but not 'Grazed x2'.
Source: D Ferrier, H van Rees, L Watson, M Peoples (2013) Vetch termination influence on the following crop. BGC Season Research Results www.farmtrials.com.au/view_attachment.php?trial_attachment_id=6267

Photo 3: *Two vetch crops conserved as manure: (left) brown manure terminated with chemical and (right) green manure terminated with cultivation. Brown manure leaves more nitrogen and ground cover to protect fragile soils.*

Photo: (left) T Bray, (right) W Hawthorne

11.2.2 Chemicals for brown manuring

A double-knock is used to achieve maximum efficacy of weed and crop kill in a brown manure. (Please see http://www.farmtrials.com.au/trial/16612)

This includes early glyphosate application at full label rate and possibly additional herbicides, to improve efficacy. Note herbicides reported in the trial are not all registered or applied at label rate. This is followed about two weeks later with paraquat application at full label rate to control of any surviving weeds. Efficacy achieved is determined by the timing of the initial 'knock'. Always follow label rates and instructions when applying chemicals.[8] [9]

8 PIRSA/GRDC (2010) Vetch: The Ute Guide. PIRSA/GRDC – https://grdc.com.au/vetch-the-ute-guide

9 Manuring of pulse crops (2013) Fact Sheet GRDC https://grdc.com.au/resources-and-publications/all-publications/factsheets/2013/09/manuring-of-pulse-crops

FEEDBACK

Table 4: Examples of vetch termination treatments and timings used in the trial reported in Table 3.

Termination date	Herbicide	
8 June	8 June	Roundup Power Max® (2 L/ha) + Lontrel® (200 mL/ha)
20 July	20 July	Roundup Power Max® (2 L/ha) + Lontrel® (300 mL/ha)
	24 July	Gramoxone® (1.5 L/ha)
19 August	19 August	Roundup CT® (2 L/ha) + Lontrel® (150 mL/ha) + Goal® 100 mL/ha) + Hasten® (1%)
	27 August	Gramoxone® (1.5L/ha)
17 September	17 September	Roundup Power Max® (2 L/ha) + Lontrel® (300 mL/ha)
	9 October	Gramoxone® (1.5 L/ha)

Source: D Ferrier, H van Rees, L Watson, M Peoples (2012) Vetch termination: finding a compromise. BGC Season Research Results http://www.farmtrials.com.au/trial/16612

11.3 Grain and seed

Although vetch is not produced for human food markets, its feed and seed markets still demand a quality sample without cracking, staining, de-hulled seeds or insect damage. Early harvest is critical to achieve a quality product.

11.3.1 Harvest timing

Vetch grain should be harvested as soon as the crop is mature. This is when upper pods turn brown and the stems are brittle enough to feed through the harvester. Moisture content of the grain should be less than 13% at harvest to meet receival standards for storage (see Table 5). If too dry, cracking may occur with downgraded quality as a consequence.

Cool, damp harvesting conditions should be avoided but harvesting early or later in the day when there is some humidity helps reduce pod shatter and seed loss. Vetch grain that is just ripe for harvest can be harvested under warmer conditions than vetch that has been left mature for some time.[10]

For early harvest, or if summer weeds would otherwise prevent timely harvest, vetch crops can be desiccated or windrowed (Section 11.3.2 Desiccation, windrowing and crop-topping). Early harvest or windrowing can help reduce seed staining from late rains and reduce pod shatter and seed loss.

10 PIRSA & GRDC (2010) Vetch: The Ute Guide – https://grdc.com.au/vetch-the-ute-guide

FEEDBACK

Table 5: Vetch minimum receival standards for farm-dressed seed.

Parameter	Requirements	Comments/variations
Physical characteristics	Vetch should be whole, sound, dry, fresh and colour typical of the variety of the season.	
Purity	97% min by weight	Includes whole vetch, skins and de-coated vetch.
Moisture	14% max	–
Defective	5% max by weight	Vetch not of the specified variety. Vetch kernels that are broken, chipped, diseased, frost damaged, insect damaged, sappy, shrivelled, split, sprouted, weather damaged, wrinkled. Includes pods that contain vetch, whether broken or unbroken and loose seed coat. Vetch where whole or part of the seed coat only is damaged, is included as sound vetch.
Mould	1 grain max per 200g	Mould (field and/or storage), caked, bin burnt and heat damaged.
Poor colour	1% max by weight	Vetch whose seed coat or kernels are distinctly off-colour from the characteristic colour of the predominating class.
Foreign material	3% max by weight of which max 2% by weight cereal grain and 0.5% max by weight unmillable material	Includes unmillable material and all vegetable matter other than vetch seed material. Includes cereal grain.
Unmillable material	0.5% max by weight (of which 0.3% max by weight of soil)	Soil, stones and non-vegetable matter.
Snails	One (1) max	Dead or alive. Whole or substantially whole (more than half) including bodies per 200 g sample.
Field insects	Fifteen (15) max	Dead or alive per 200 g sample.
Grasshoppers and locusts	Two (2) max	Dead or alive per 200 g sample.
Foreign seeds	–	–
Objectionable material	Nil tolerance	Includes objectionable odour.
Ryegrass ergot	Two (2) cm max	Pieces laid end to end per 200 g sample.

Source: Pulse Australia (2016) Australian Pulse Standards, http://www.pulseaus.com.au/marketing/receival-trading-standards

FEEDBACK

MORE INFORMATION

GRDC Pre-harvest herbicide use Fact Sheet, http://www.grdc.com.au/GRDC-FS-PreHarvestHerbicide

11.3.2 Desiccation, windrowing and crop-topping

While these three practices produce a similar end point – a dry crop to harvest – they have different additional outcomes.

- **Desiccation** – used to achieve early harvest, even crop ripening and to 'brown off' late weed growth to make harvest easier. Desiccation advances maturity up to 10 days.
- **Windrowing** – for uniform ripening and earlier grain harvest or directly in front of the harvester to reduce snail contamination.
- **Crop-topping** – to control seedset in escaped weeds, often grass weeds, and to ripen vetch earlier.

Desiccation

Spray with registered herbicides, such as paraquat (check product labels as not all are registered for this use in vetch), once grains have reached physiological maturity; grain moisture is about 30%, usually 20–30 days after the end of flowering. The lower 75% of pods are turning black and seeds are firm with thin and leathery shells.

Harvest 7–10 days after desiccation. Observe withholding period to avoid chemical residues in grain.

Windrowing

Windrowing pure vetch (versus a mixture of cereal and vetch) is not commonly done and windrows need to be of sufficient bulk to prevent blowing around in strong winds. Cutting wide swaths combining them into a bulky windrow and rolling immediately using a 'cotton-reel roller' to compact the windrow will reduce the risk of being blown around.

The advantages of windrowing for grain harvest are.

- Uniform maturity of the crop for harvest.
- Earlier harvest at higher grain-moisture content.
- Early harvest to avoid seed staining from late rains.
- Easier harvest with fewer losses when lodged.
- Less pod splitting and shattering if rain occurs.
- Lower cutter bar height, especially in short crops, enabling lowest pods to be harvested.
- Late-maturing weeds dried to enable earlier harvest.
- Less loss from pod shatter than weather-delayed harvest of standing crop if harvest were delayed.
- Reduced snail contamination in the sample if windrowed late directly in front of the harvester.
- Destruction of weed seeds when windrows are (hot) burnt.

A disadvantage of windrowing is the transfer and concentration of nutrients, especially potassium, into windrows.

Crop-topping

Earlier-maturing varieties allow optimal timing of crop-topping to achieve good control of weed seedset with minimal effect on grain yield.

Crop-top as late as possible (i.e. dough stage of the ryegrass), when 50% or more vetch seeds within the pods have changed from green to yellow.

Crop-topping too early, particularly in later-maturing varieties, risks loss in vetch grain yield and increased numbers of seeds with poor quality (darkened seed coats or small, green, immature seeds.

Avoid using coloured foam markers when crop-topping as these may stain vetch seed through the pods.

FEEDBACK

MORE INFORMATION

GRDC Reducing harvester fire risk: The Back Pocket Guide, http://www.grdc.com.au/GRDC-BPG-ReducingHarvesterFireRisk

Grain Harvesting Code of Practice, http://www.cfs.sa.gov.au/site/prepare_for_a_fire/cfs_codes_of_practice_jsp

Weed wiping can be used with some success in vetch to prevent seedset of ryegrass and other tall weeds that stand above the lodged crop. However, in some cases vetch crops might be too tall or bulky for the ryegrass for this to be a reliable option.

11.3.3 Harvester equipment and set-up

Vetch can be harvested with a conventional or rotary combine harvester. Harvesting problems are often associated with severe lodging, short crops with little growth and their pods close to the ground, or excessive harvesting speed. The use of either crop lifters or a flexible or Draper-type pick-up front is needed to harvest the grain crop from windrows.

Vetches thresh readily, so to minimise seed damage and losses during harvest it should not be heavily threshed. This can be achieved by using low drum speed and with adequate concave clearance (Table 6). Use maximum wind and sieve settings for the grain size, and try to use draft to remove trash. The rake at the back of the sieve may need to be turned off to stop weeds entering the returns.

Where summer weeds are present, desiccation would be useful, otherwise increase drum speed to prevent harvester blockages.

Excessive harvesting speeds should be avoided to minimise feed-in problems.

Axial or rotary harvest drums cause less seed damage, and harvesting earlier in the day when conditions are less dry can help minimise damage.

11.3.4 Harvesting fire safety

Pulse dust is flammable and likely to cause fires. Be wary of slipping belts and collapsed bearings that could ignite the dust. To reduce the fire risk, remove the build-up of dust and clean the engine daily. Drag an earthing chain to reduce static electricity on the header. Keep a fire-fighting unit nearby during harvest and carry an extinguisher on the harvester, just in case a fire does start.

There are several important things that reduce the risk of fires:[11]

- operate only when the conditions are favourable under the Grain Harvesting Code of Practice.
- Diligent, regular clean down of residues especially with legumes.
- Check under guards and covers for build-up of dust and chaff.
- Check bearings and moving parts for hot spots (use a hand-held digital thermometer).
- Check electrical system for worn cables (especially from rodent damage).
- Check fuel and hydraulic lines for leaks.
- Use a drag chain to avoid build-up of static electricity.
- Use the battery isolation switch when the header is not in use.
- Locate fire-fighting gear close by.
- Train all staff in using fire-fighting equipment.

11 P Bowden (2016) Avoiding Harvester Fires. Pulse Australia http://pulseaus.com.au/blog/post/avoiding-harvester-fires

Table 6: A guide to harvester set-up for various pulse crops including vetch.

	Lentil (red)	Lupin	Pea	Vetch
Reel speed	Slow	Slow	Medium	Slow
Spiral clearance	Low	High	Standard	Low
Thresher speed	400–600	400–600	400–600	400–600
Concave clearance	20–30 mm	10–30 mm	10–30 mm	10–30 mm
Fan speed	Medium	High	High	Medium
Top sieve	32 mm	32 mm	32 mm	32 mm
Bottom sieve	10 mm	16 mm	16 mm	10–16 mm
Rotor speed*	Slow	700–900	700–900	Slow

* Rotary machines only
Source: J Lamb, A Poddar (2008) Grain Legume Handbook for the Pulse Industry. Grain Legume Hand Book Committee, https://grdc.com.au/grainlegumehandbook

11.3.5 Harvesting for seed

When harvesting for seed, either for market or to be home saved, select an area of a paddock where there has been good nutrition and minimal disease, pest and weed infestation. This will help to ensure maximum germination and minimal weed and disease carryover. Ensure headers, bins, augers and other equipment are free of grain and weed contaminants. The middle of the crop is likely to be the best area for seed production as weed and insect problems are usually worst at the edges.

(See Section 12 for more information on grain storage).

11.3.6 Weather-damaged grain

Photo 4: *Weather events prior to harvest can result in visual damage to the seed coat or kernel including poor colour, loose seed coat, sprouting and wrinkling.*

Photo: Emma Leonard, AgriKnowHow

Weather-damaged seed generally shows visual damage symptoms to the seed coat or kernel due to some form of weather event prior to harvest. Weather damage may lead to poor colour, loose seed coat, sprouting, wrinkling or other defects.

Wrinkled seed – arises from stress during the maturation phase that causes damage to the seed coat. The seed coat will be significantly indented into the kernel as coarse rather than soft waves.

FEEDBACK

Loose seed coat – is caused by weather conditions, such as rain near harvest, or poor handling or harvesting techniques. It results in breakage or cracking of the seed coat that might be separated from the kernel or about to separate.

Shrivelled seed – arises from some form of stress during the maturation phase. Seed coats may be wrinkled, significantly indented into the kernel and tightly adhere to the kernel. Grains are often smaller than the majority of the sample.

Weather damage can be managed by:

- desiccation or windrowing vetch and harvesting as early as possible for grain; or
- growing vetch as a forage crop and cutting as hay or silage to avoid weather damage at grain harvest.