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GRAINS RESEARCH  
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# FABA BEAN

## SECTION 12

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## HARVEST

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TIMING THE HARVEST | IMPLEMENTING EARLY-HARVEST MANAGEMENT  
| HARVESTING AND HEADER SETTINGS | MODIFICATIONS AND HARVEST  
AIDS | ACHIEVING A CLEAN SAMPLE | LODGED CROPS | GROWER-KEPT  
SOWING SEED

# Harvest

## Key messages

- Yield losses increase significantly the longer harvest is delayed.
- Early-harvested grain means less disease and weathering, and better colour.
- Rotary harvesters cause less grain damage than conventional harvesters.
- Even at low moisture content, early-harvested faba bean seed is more resilient against breakage during harvesting and subsequent handling.

FAQ

## 12.1 Timing the harvest

Early harvest of pulses is critical, because delays can result in significant yield losses due to lodging, shattering and pod loss. Grain quality, and hence price, can also suffer through mechanical damage or weathering and seed staining. Moisture levels at harvest affect the quality of the grain in storage.

If harvesting grain for seed, germination rates are improved if grain is harvested at 12–14% moisture and then stored in aerated silos or immediately graded and bagged. Crop desiccation with herbicides prior to crop maturity may reduce grain quality and seed germination.

A grower's decision to delay faba bean harvest is usually influenced by the following factors:

- Faba bean harvest can clash with cereal harvest. Faba beans are still largely considered a 'secondary' crop, with wheat or barley taking precedence at harvest time.
- The perception that faba beans 'weather' reasonably well, although this is a fallacy (see later discussion).
- Uneven ripening of faba bean crops can occur if not desiccated or windrowed, especially when grown on heavy clay soils or variable soil types. Having a good even plant stand helps to keep the crop even as dry-down occurs prior to harvest.
- Faba beans are considered slower or more difficult to harvest. This does not have to be the case if desiccation is used, and the header is modified to suit them.<sup>1</sup>

### 12.1.1 Yield losses

Yield losses increase significantly the longer harvest is delayed.

Although faba beans are not normally prone to pod splitting and shelling out in all but extreme wet-weather conditions, they are very prone to pod splitting and pod drop after wet weather once the plant has dried down. Weathering of the grain can also occur in split pods.

Yield losses of up to 30% have been recorded in the field:

- It is estimated grain losses due to a two to four week delay in harvest range from A\$93–\$238/ha, depending on seasonal conditions.
- Most of the losses are due to pod loss at the header front, or unthreshed pods lost out the back of the machine.

Lodging can increase as faba beans are left standing, and the risk is higher if the crop is high-yielding and has been planted on wide rows.

Loss of moisture below the national pulse receival standard of 14% moisture content results in a substantial loss to the grower, as this example shows:

<sup>1</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

- 500 t of faba bean at 14% grain moisture, valued at \$450/t, is worth \$225,000.
- The same grain harvested at 8% moisture delivers 470 t, so at \$450/t is worth \$210,600.
- This is a loss to the grower of \$14,400. <sup>2</sup>

### 12.1.2 Deterioration in grain quality

Grain quality deteriorates the longer mature faba beans are left exposed to weathering in the field.

The seed coat of faba bean is very prone to cracking if it has been exposed to wetting and drying due to rain or heavy dew. Expansion of the seed as it absorbs moisture, and then contraction as it dries, weakens the seed coat. This renders it much more susceptible to mechanical damage during harvest and handling.

Levels of cracked and damaged grain can be as high as 50% in extreme cases of field weathering and prolonged rainfall.

Early-harvested faba bean seed is much more resilient to breakage during harvesting and subsequent handling, even at low moisture contents.

Some faba beans are processed into dhal or flour by removing the seed coat (hull) and splitting the cotyledons. Visual appearance is still critical for marketing though. Older seed that has darkened with age splits better than new-season grain. The milling process uses abrasive mills to gradually abrade the seed coat from the cotyledons, so the process relies on the seed coat being firmly attached to the cotyledons.

Cracking and weakening of the seed coat prior to processing substantially reduces the recovery percentage of splits, as well as reducing the quality of the final product.

Field-weathered faba beans after rain are also more difficult to thresh out at harvest, and often contain much higher levels of unthreshed pods and pod material.

Faba bean seeds discolour and darken when exposed to field weathering. Darkening of the seed coat is caused by oxidation of polyphenol compounds (tannins). The following conditions play a major role in accelerating seed coat darkening:

- rainfall
- cool–mild temperatures
- high humidity
- sunlight

Usually, there is no direct penalty or discount for a moderate degree of seed coat darkening; however, it does have a significant impact on the marketability of the product and the reputation of the Australian industry as a supplier of quality product. Quality is becoming increasingly important as Australian traders attempt to establish market share against other faba bean-exporting countries (particularly France and the UK). We are likely to see much greater segregation according to seed coat colour, and premiums paid for lighter coloured, large-seeded faba bean types, as new varieties with these traits are developed and the Australian industry becomes more quality-conscious.

Several other problems can lessen seed quality:

- Weathering of seed due to delays in harvesting can substantially increase mould infection levels. High levels of mould infection will also cause darkening of the seed coat. Humid (>70% relative humidity), wet conditions favour the development of a range of fungi in late-harvested faba bean crops.
- Increased risk of late *Ascochyta* infection can develop on dry senescing pods under wet conditions, and can penetrate through to the seed in susceptible varieties. The current export receival standard for visible *Ascochyta* lesions is a maximum of 1% on the seed cotyledon (kernel).

<sup>2</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

**i MORE INFORMATION**

[The current Australian Pulse standards](#)

- Native budworm (*Helicoverpa punctigera*) can occasionally attack senescing faba beans, particularly where rainfall has softened the pod. Insect-damaged seeds are classified as defective faba beans, and they cannot exceed the tolerance level of 3%.<sup>3</sup>

### 12.1.3 Missed marketing opportunities

Delayed harvest often means that growers miss out on premiums paid for early-harvested crops of good quality. This is the case in most years, with the possible exception occurring where major production problems have been encountered and there is a 'shorts' market place. Weathering and mechanical damage is also more likely in late-harvested crops.

Early harvest gives the grower some degree of control over how and when the crop is marketed, whereas growers of late-harvested faba beans can often be 'price-takers' in a falling market, or may encounter delivery delays.<sup>4</sup> If the market starts to slide, many farmers will put the faba beans into storage and market them away from the harvest period, often prepared to leave them in storage until they get the price that they want.

## 12.2 Implementing early-harvest management

A range of management components contribute to an early-maturing crop, and all can be important at different times and for different reasons. It is important to understand the potential and limitations of each component. Optimal results in terms of yield, profit and timing will come from these components being applied in the most appropriate and balanced way, and as dictated by seasonal conditions.

These components include:

1. Sowing
  - Sow at the earliest opportunity, but within the preferred planting window for your area.
  - Moisture-seeking equipment and/or press-wheels can significantly enhance seeding opportunities under marginal soil moisture conditions. The success of moisture seeking, particularly in marginal conditions, is increased greatly by running a set of Kelly discs (or something similar) over the paddock immediately after planting and before applying residual herbicides. This seems to prevent drying down into the disturbed soil and helps to achieve a more uniform establishment of the crop.
  - Use adapted varieties that meet your target for early harvesting.
  - Precision planters or machines with automatic depth control will often achieve more uniform plant establishment and crop development, and consequently more even crop maturity. This is particularly so when sowing into marginal soil moisture and drying conditions.
2. In-crop management
  - Control Botrytis grey mould if present during flowering.
  - Control native budworm during flowering to maximise early podset.
3. Harvest management
  - Consider windrowing to enable earlier maturity and harvest date.
  - Consider using a desiccant to dry late plants and any weeds.
  - If using glyphosate (or equivalent registered products) to terminate crop growth at the 80–90% black–brown pod stage, be aware of potential impacts on seed quality.
  - Set up the header to operate efficiently at 14–15% grain moisture content.

<sup>3</sup> Pulse Breeders Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

<sup>4</sup> Pulse Breeders Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

**i MORE INFORMATION**

R Barr (2016) Paraquat preferred for crop-topping pulses. GRDC Ground Cover Issue 124, September-October 2016.

- A major advantage of high-moisture harvesting is that harvest can commence earlier in the season and earlier each day. For example, harvesting at 14% moisture content rather than 12% can effectively double the harvest period available on any one day in hot environments.
- Blend, aerate and/or dry the sample to the required receival standard of 14% moisture.<sup>5</sup>

### 12.3 Harvesting and header settings

Faba beans can be harvested with minor adjustments and modifications to machinery. They are easily threshed, so open the concave clearance and reduce the drum speed.

If there are many summer weeds, the drum speed may need to be increased to ensure weeds do not block the machine. Pulses are larger than wheat, so a concave with many wires or blanked-off sections can stop grain separation. To get the best performance, alternate wires and blanking-off plates will have to be removed. Maximum wind settings and barley sieve settings should ensure a good sample (Table 1).

When harvesting pulses for seed, take extra care to reduce grain cracking, even if this means making a poor sample. Gentle harvesting will give the best seed quality. Rotary harvesters are gentler on the crop and generally cause less grain damage than conventional harvesters.

Faba beans vary in height from 15 to 80 cm, with pods held up in the canopy. This means direct heading without crop lifters is possible with open-front and closed-front machines. Some fingers may have to be removed when using closed-front machines. Adjust thresher speed (400–600 rpm) and concave (10–30 mm) to suit. Removing alternate wires and blank-off plates from the concave will help to reduce cracking. If possible, cover the rasp bars with plates.

Harvesting grain at high moisture levels up to 14% should minimise cracking.<sup>6</sup>

**Table 1: Harvester settings for pulses.**

	Chickpeas	Faba beans	Green lentils	Red lentils	Lupins	Field peas	Vetch
Reel speed	Medium	Slow	Slow	Slow	Slow	Medium	Slow
Spiral clearance	High	High	Low	Low	High	Standard	Low
Thresher speed (rpm)	400–600	400–600	350–450	350–450	400–600	400–600	400–600
Concave clearance (mm)	10–30	15–35	20–30	10–20	10–30	10–30	10–30
Fan speed	High	High	High	High	High	High	Medium
Top sieve (mm)	32	32–38	32	16	32	25	25
Bottom sieve	16	16–19	8–16	3–10	16	16	10–16
Rotor speed (rpm)	700–900	700–900	350–450	350–450	700–900	700–900	Slow

Source: Grain Legume Handbook, 2008

<sup>5</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

<sup>6</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course Module 8—Desiccation, Harvest & Storage, 2013.GRDC/Pulse Australia.

## 12.4 Modifications and harvest aids

A straw chopper may be of value to chop up the stubble and spread it uniformly. Crop lifters are not required unless the crop is badly lodged or late-sown and drought-affected.

Finger reels are less aggressive than bat reels and cause fewer pod losses. Set the finger tine reel to force the material down onto the front. Moving the broad elevator auger forward can improve the feeding of light material.

Vibration due to cutter-bar action, plant-on-plant or reel-on-crop impact, and poor removal of cut material by the auger all cause shattering and grain loss.

Double-acting cutter-bars reduce cutter-bar vibration losses. Four-finger guards with open second fingers also reduce vibrations (Figure 1).

A lupin breaker is a cheap and simple device that can increase harvesting capacity to reduce grain loss. It is a small, serrated plate that attaches to the front spiral and creates an aggressive, positive feed action to clear-cut material from the front of the knife.



**Figure 1:** Four-finger guards to reduce vibration.

Source: W. Hawthorne, Pulse Australia

Other options are available to improve pulse harvesting (Photos 1–4). The costs and benefits must be assessed, because a small area of pulses may not justify the cost of some of the above modifications.<sup>7</sup>

### *Aussie-Air*

The Aussie-Air directs an air blast through the reel fingers, and is suitable for both heavy and light crops.

The manufacturer claims an extra 15 horsepower is required to drive an Aussie-Air, but there is also an overall lesser horsepower requirement because of wider concave clearances. The actual horsepower required should be no more than for a heavy cereal crop.

### *Harvestaire*

The Harvestaire (Photo 4) replaces a reel with a manifold that directs a blast of air into the front:

- The manifold causes some interference with the incoming crop.
- Correct orientation of air blast is very important.
- An optional secondary fan to increase the air blast is worthwhile.

<sup>7</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

- The device is more effective in light crops.

#### *Vibra-mat*

The Vibra-mat (Photo 4) is a vinyl mat that vibrates with the knife, stops bunching at the knife of open front headers, and helps the table-auger to clear-cut materials. Its chief advantage is that it is very cheap. It is more effective in light crops.

It is important to match groundspeed to table-auger capacity and crop density: too slow and the plants will not have enough momentum to carry to the front; too fast and the cut crop will not be cleared from behind the knife.

#### *Extension fingers*

Plastic extension fingers, ~30 cm long, that fit over existing fingers can save significant losses at the knife for little financial outlay (Photo 3). Pods that would have fallen in front of the knife are caught on the fingers and pushed into the comb by the incoming crop.

#### *Extended fronts*

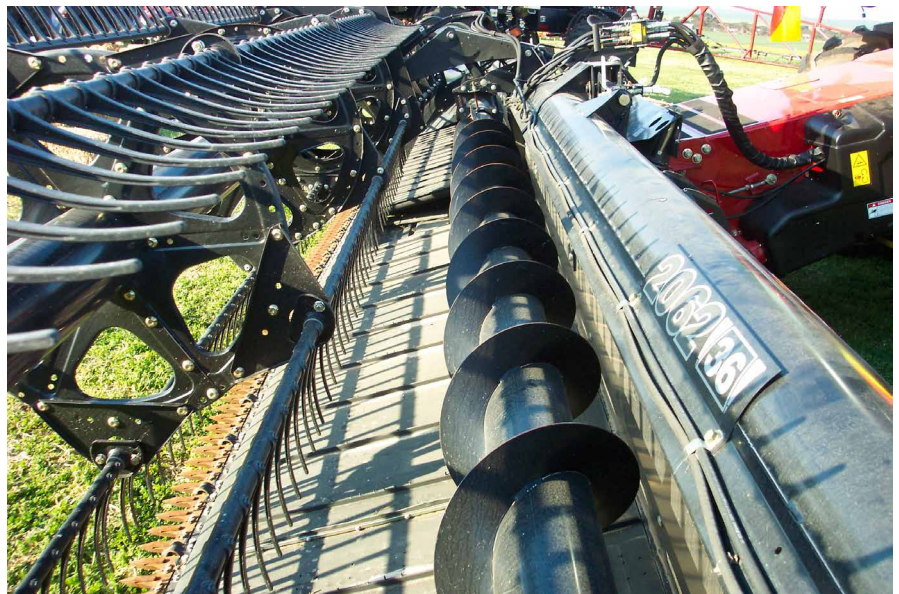
Extended fronts are now available for some headers and reduce losses at the knife by increasing the distance between the knife and auger to a maximum of 760 mm. This helps to stop losses caused by material bunching in front of the auger, where pods can fall over the knife and be lost.

#### *Platform sweeps*

Platform sweeps are used in conjunction with extended fronts. They consist of fingers that rake material towards the auger to help eliminate bunching. They can also be used on conventional fronts.

#### *Draper fronts*

Draper fronts such as MacDon® and Honeybee® have large clearances behind the knife and carry the crop to the elevator. The front can also be used for cereals without modification.<sup>8</sup>



**Photo 1:** *Belt-front fitted with cross-auger.*

Photo: W. Hawthorne, Pulse Australia

<sup>8</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

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**Photo 2:** *Short fingers on a flex-front.*

Photo: Grain Legume Handbook, 2008



**Photo 3:** *Plastic extension fingers fitted to a draper front.*

Photo: G. Cumming, Pulse Australia





**Photo 4:** *Harvestaire front combined with extension fingers and a blue Vibra-mat.*

Photo: G. Cumming, Pulse Australia

## 12.5 Achieving a clean sample

Harvesting faba beans can be costly if debris such as stones, sticks or too much dirt is picked up with the crop. Machinery damage can be reduced by a variety of practices.

### *Rolling for harvest efficiency*

Harvester damage may be reduced by rolling paddocks after sowing to flatten and firm soil and depress obstacles such as stumps and stones.

A flat soil surface at harvest becomes even more essential when crops are short in height at maturity or are tall but have lodged. Rolling after sowing to aid harvesting is required where the height of the crop to the lowest pods is low, which occurs particularly in lower rainfall areas or late-sown crops. Taller faba beans in higher rainfall or irrigation areas may also need rolling if lodging by harvest time is likely.

Another reason for rolling soils is to leave a flat soil surface for post-sowing herbicides to prevent herbicides washing out and accumulating in furrows.

Rolling also improves seed–soil contact in sandy, non-wetting soils, although press wheels normally will have achieved this.

### *Perforated screens*

Perforated screens fitted on the bottom of the broad elevator, cross-augers, and grain and seconds elevators reduce the amount of dirt in the sample.

The perforated screen at the broad elevator is large and removes the dirt before it enters the main working mechanism of the harvester.

### *Harvester speed*

Excessive harvester speeds will cause large losses of grain and force more dirt into the harvester. Generally, speeds >8 km/h are not recommended, irrespective of the type of harvester front used.

### *Harvesting in high humidity*

Harvesting in humid conditions, when pods are less prone to shatter, can reduce grain losses. However, more unthreshed pods may appear in the grain sample. It is more difficult to harvest faba beans at night unless using a pick-up front or some positive height control, which will stop the front from digging into the dirt. Some growers have fitted wheels on the outer end of their fronts, as a depth-stop. Others have bought ultrasonic automatic depth controls to control header height.

### *Pick-up fronts*

Pick-up fronts the same as or similar to those used for picking up windrows can be used to harvest windrowed faba beans. The pick-up fronts greatly reduce the amount of dirt entering the harvester and make harvesting easier, because harvesting height is not as critical as with a front fitted with lifters.

Pick-up fronts also make harvesting at night easier. The fingers on the pick-ups are closely spaced and they will gather the entire crop, so crop losses are reduced.

There are different types of pick-ups. Some have fingers attached to rotating belts (draper pick-ups) and others have fingers attached to rotating drums (peg-roller pick-ups). The peg-roller types are similar and cheaper, but tend to shatter pods and cause slightly higher grain losses than the draper type. The draper types are more expensive but will reduce losses if harvesting late.

### *Flexible cutter-bar fronts (flexi-fronts)*

The cutter-bars of flexi-fronts are hinged in short sections, allowing the whole front to flex and closely follow the ground contour. The use of skid plates are particularly good for short crops such as lentils and field peas, but can also be used on cereals by locking the hinged sections together.<sup>9</sup>

## **12.6 Lodged crops**

If the crop has lodged, it is usually best to harvest in the opposite direction, or at right angles, to the direction the crop has fallen. Crop lifters may help, but can be difficult in control traffic situations.

If the crop was sown on wide rows, use crop lifters and harvest up and back in the rows. The crop usually feeds in better over the knife section, and also provides the header operator with a better view of any rocks or sticks in the paddock.

An even plant stand and the correct population density will minimise the impact of lodging at harvest time, because the plants lean on each other as they start to lodge and the header can usually still get under the lowest pods.<sup>10</sup>

## **12.7 Grower-kept sowing seed**

The best area of a paddock should be selected and marked out well before harvest. Choose areas where weeds and diseases are absent and where the crop is vigorous and healthy, likely to mature evenly and develop good grain size. Also select areas at least 500 m away from other faba bean varieties, to reduce cross-pollination and, hence, contamination. Seed from this area should be harvested first, ideally at 11–13% moisture to avoid low-moisture grain that is susceptible to cracking.

Do not use glyphosate to desiccate the area that will be kept for seed. Desiccated crops are likely to produce poor germination quality seeds, so it is best to avoid keeping seeds from that area. Read the glyphosate label.

9 Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

10 Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 8—Desiccation, Harvest & Storage.

Seed-borne diseases can lower germination levels. Specialist laboratories can conduct tests for the presence in seed of a number of diseases, such as Ascochyta blight and Botrytis (chocolate spot or grey mould) in faba bean and chickpea.

Seed with poor germination or high levels of seed-borne disease should not be sown. The cheaper cost of retaining this seed will often be offset by higher sowing rates needed and the risk of introducing further disease into the crop.

The only way to accurately assess the germination rate, vigour and disease level of seed is to have it tested.<sup>11</sup>

### 12.7.1 Safe storage of seed

Retained seed must be stored correctly to ensure that its quality is maintained. Ideal storage conditions for pulses are at ~20°C and 12.5% moisture content.

Faba beans may be stored in sheds, bunkers, grain bags and silos. They do not suffer from pea weevil infestations; therefore, a sealed silo is usually not necessary.<sup>12</sup>

As with other grains, faba bean seed quality can deteriorate in storage, and the most rapid deterioration occurs under conditions of high temperature and moisture. Crops grown from seed stored under these conditions may have poor germination and emergence.

It is best not to store faba beans in bunkers or in grain (or 'sausage') bags for any length of time, because pockets of moisture can lead to black, mouldy grain, which can contaminate the remainder of the product (see Section 13). Black, mouldy grain can also taint the sample with an unpleasant odour, rendering it unacceptable for consumption.<sup>13</sup>

Reducing moisture and temperature increases longevity of the seed, although storage at very low moisture contents (<10%) may render faba beans more vulnerable to mechanical damage during subsequent handling. See Table 2 for an example with chickpea.

**Table 2: Effect of moisture content and temperature on storage life of chickpea seed.**

Storage moisture (%)	Storage temperature (°C)	Longevity of seed (days)
12	20	>200
	30	500–650
	40	110–130
15	20	700–850
	30	180–210
	40	30–50

Note: Most sowing seed will need to be stored for a period of ≥180 days  
Source: Ellis et al. 1982

Storage at >13% moisture under Australian conditions is not recommended. Reducing temperature in storage facilities is the easiest method of increasing seed longevity. Not only will it increase the viable lifespan of the seed, it will slow the rate at which insect pests multiply in the grain.

To reduce temperature in grain silos:

11 Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 4—General Agronomy.  
12 Victoria DEPI (2013) Growing faba bean. Note AG0083, <http://www.depi.vic.gov.au/agriculture-and-food/grains-and-other-crops/crop-production/growing-faba-bean>  
13 W Hawthorne (2008) Faba beans—For quality markets. Australian Pulse Bulletin No.14, Pulse Australia. [http://pulseaus.com.au/storage/app/media/crops/2008\\_APB-Faba-beans-quality-markets.pdf](http://pulseaus.com.au/storage/app/media/crops/2008_APB-Faba-beans-quality-markets.pdf)

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- Paint the outside of the silo with white paint. This reduces storage temperature by as much as 4–5°C and can double the safe-storage life of grains.
- Aerate silos with dry, ambient air. This option is more expensive, but in addition to reducing storage temperatures, it is effective in reducing moisture of seed harvested at high moisture content.
- Heat-drying of faba bean sowing seed should be limited to temperatures <40°C.<sup>14</sup>

<sup>14</sup> Pulse Breeding Australia (2013) Southern/Western Faba & Broad Bean—Best Management Practices Training Course. Module 4—General Agronomy.