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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

FABA BEAN

SECTION 12

HARVEST

KEY POINTS | HARVESTING FOR SEED CROPS | THE IMPACT OF DELAYED HARVEST ON PROFITABILITY | PLAN AHEAD FOR SUCCESSFUL EARLY HARVEST | PADDOCK PREPARATION | MOISTURE CONTENT AND TEMPERATURE | HARVESTER SET-UP | HARVESTING WINDROWS | LODGED CROPS | MANAGING SNAILS | ASSESSING HARVEST LOSS | HARVEST FIRE RISK | HANDLING AND MOVING FABA BEAN | RECEIVAL STANDARDS | GRAIN DELIVERY

Harvest

Key points

- Harvest early for better quality and to avoid physical damage during the process. Managing for an early harvest begins with sowing on time.
- Windrowing or desiccation helps to enable an earlier harvest date.
- Faba bean is marketed on visual appearance and maintaining a high-quality product is essential to Australia being able to compete on the international market.
- The large grain of faba and broad bean is easy to crack and needs to be harvested gently. Adjust harvester settings to minimise cracking and blockages.
- Harvest at moisture levels up to 12—14% to avoid damage to the grain. Harvest in humid conditions early in the day or into the evening. When harvesting in extreme heat. or when the crop is too dry. makes the lower pods prone to shattering and the grain vulnerable to cracking.

FEEDBACK

MORE INFORMATION

See the GroundCover™ article: Profitable pulses – it's all about the harvest window, https://grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-118-sep-oct-2015/profitable-pulses-its-all-about-the-harvest-window

The key to maximising profit from pulses is grain quality.[1] Human food markets demand a quality sample without cracking, staining, de-hulled seeds or insect damage. Visual appearance is everything. Therefore, the most important factors when harvesting faba bean are to harvest early for better quality and to avoid physical damage during the process.

12.1 Harvesting for seed crops

When harvesting for seed, choose an area of the paddock where there has been minimal disease, pest and weed infestation. This will maximise germination and minimise weed and disease carryover. The middle of the crop is likely to be the best area for seed production as weed and insect problems are usually worse at the edges.

A gentle harvest will provide the best seed quality.[2] It is important to minimise grain cracking even if it results in a poor sample. The seed can always be cleaned before sowing. Rotary harvesters are more gentle and will cause less damage to the seed than conventional harvesters.

Germination rates are improved if seed is harvested at 12–14% moisture and stored in mesh silos, aerated, or immediately graded and bagged. Ensure headers, bins, augers and other equipment are free of grain contaminants.

Seed harvested earlier is less likely to harbour diseases such as Ascochyta.

Avoid desiccating or crop-topping of seed crops as this can reduce germination rate. (Also see Section 3.10 Seed quality).

12.2 The impact of delayed harvest on profitability

If managed correctly, pulses can be more profitable than cereals. Sow and harvest on time to maximise returns.

Some reasons why people delay harvest of pulses include:

- When there is a clash with cereal harvest, bean crops are often treated as second best compared with cereals.
- Perceived better chance of achieving premiums for Prime Hard or Australian Hard wheat or malting for barley. In reality, the premiums for harvesting pulses at the optimum time are often greater, or the penalties more severe from delays.
- The false perception that pulses tolerate weathering.
- Uneven ripening if not desiccated or windrowed, especially when grown on heavy clay or variable soils.
- The false belief that pulses are slower or more difficult to harvest. Desiccation or windrowing and careful harvest set-up can overcome these difficulties.

Despite these beliefs, delaying harvest is not recommended. The impact of delays include:

- yield loss;
- deterioration in grain quality;
- missed marketing opportunities; and
- a more difficult harvest.

1 T Yeatman, W Hawthorne, J Paull, J Bellati, J Egan, K Henry, R Kimber, M Seymour, J van Leur, K Lindbeck, P Matthews, I Rose (2009) Faba Beans: The Ute Guide. Primary Industries and Resources South Australia, https://grdc.com.au/resources-and-publications/all-publications/publications/2009/11/faba-beans-the-ute-guide/

2 J Lamb, A Podder (2008) Grain Legume Handbook for the Pulse Industry. Grain Legume Hand Book Committee, https://grdc.com.au/grainlegumehandbook

FEEDBACK

MORE INFORMATION

The Pulse Australia Visual guide 'Common defects of beans' can be found at http://pulseaus.com.au/storage/app/media/markets/2009_FabaBroadbean-visual-quality.pdf

Pulse Australia webpage: Receival and trading standards, http://www.pulseaus.com.au/marketing/receival-trading-standards

12.2.1 Yield losses

It is not unusual to see a 4–6 week spread in the harvesting of faba and broad bean crops planted on the same sowing rain. Many late-harvested crops are often down around 8% moisture content, whereas the maximum moisture content for receival is 14% and preference is for 12%.

Grain with a lower moisture content at delivery will weigh less and return less money to the grower, for example:

- 500 tonnes of faba bean at 14% grain moisture and $450/t is worth $225,000
- the same grain harvested at 8% moisture delivers 470 t, and at $450/tonne is worth $210,600
- this is a loss to the grower of $14,400.

Delaying harvest can lead to an increase in lodging, shattering and pod loss. Yield losses of up to 30% have been recorded in the field.

Most of the losses were either due to pod loss at the header front, or as unthreshed pods lost out the back of the machine. Field-weathered faba and broad beans after rain are also more difficult to thresh out at harvest, and often contain much higher levels of unthreshed pods and pod material.

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

Photo 1: *Harvest as soon as beans are mature.*

Photo: Wayne Hawthorne, formerly Pulse Australia, via Yeatman *et al* (2009)

12.2.2 Quality losses

Early-harvested grain is of better quality in terms of colour, weathering and disease. Early-harvested seed is also more resilient against breakage during harvesting and subsequent handling, even at low moisture contents.

Marketing

Faba bean is marketed on visual appearance and maintaining a high-quality product is essential to Australia being able to compete on the international market. Some beans are sold for processing into dahl or flour by removing the seed coat and splitting the cotyledons. Older seed splits better than newer grain but the seed coat is more likely to crack before processing. As the milling process relies on the seed coat remaining firmly attached to the cotyledons this can reduce the percentage of splits and the quality of the final product.

FEEDBACK

Faba and broad beans that do not meet the Number 1 Receival Standard of 6% defective beans will need to be graded or downgraded. (See Section 12.13 Receival standards). This incurs a cost to the grower of:

- $15—$25/t grading costs; and
- downgrading of the seconds into the stockfeed market at a value of $120—$140/t.

Cracking

The seed coat of faba and broad beans is very prone to cracking if it has been exposed to wetting and drying events, due to rain or heavy dew. The seed expands as it absorbs moisture and contracts as it dries, weakening the seed coat. This makes it much more vulnerable to mechanical damage during harvest and handling operations.

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

Darkening

Darkening of the seed coat is caused by oxidation of polyphenol compounds (tannins). Darkening of the seed coat is a natural process, but is accelerated by:

- rainfall;
- cool-mild temperatures;
- high humidity; and
- sunlight.

While there is usually no direct penalty or discount for a moderate degree of seed-coat darkening, 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 bean-exporting countries, such as France and the UK. Because of the darkened seed coat, carrying faba bean over from one season to the next limits its marketability to either feed markets or to a processor that can dehull them.

It is highly likely that there will be greater segregation and premiums paid for lighter-coloured, large-seeded faba and broad bean as new varieties with these traits are developed. The Australian industry, through our overseas markets, has become more quality conscious. Newer, lighter-coloured varieties do darken slower than the older varieties and are well accepted in the main Middle Eastern markets.

Pests and diseases

Weathering increases the potential for diseases and pest damage.

Humid and wet conditions favour mould infection, most commonly *Alternaria*, but also *Aspergillus*, *Cladosporium* and *Penicillium*. High levels of mould infection will also cause darkening of the seed coat.

Late infection of Ascochyta can develop on dry, senescing pods under wet conditions, and can penetrate through to the seed in susceptible varieties. Receival standards for visible Ascochyta is a maximum of 1%.[3]

Native budworm can occasionally attack rain-softened pods. Insect-damaged seeds are classified as defective beans with a maximum tolerance of 3%.

Early harvest is recommended for crops with high snail populations. As the season progresses, snails are harder to dislodge from the canopy and are less likely to move down the canopy after light rain.

Pulse Australia has produced a visual guide to the common quality defects in beans (Figures 1–3).

3 Pulse Australia (2016) Receival & trading standards. Pulse Australia, http://www.pulseaus.com.au/marketing/receival-trading-standards

FEEDBACK

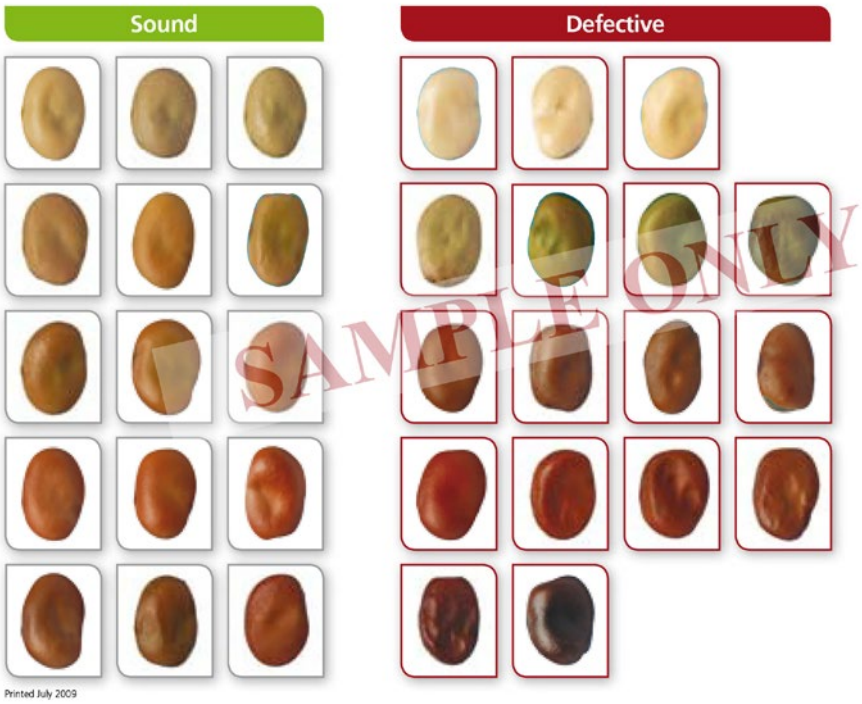

Figure 1: *Common quality defects of beans – colour.*

Source: Pulse Australia (2016)

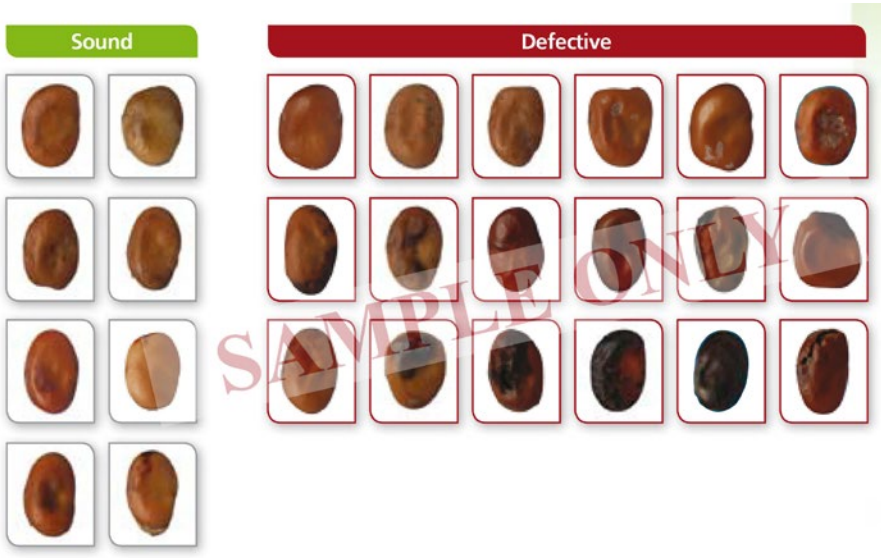

Figure 2: *Common quality defects of beans – bin-burnt, heat-damaged, mould-affected, insect-damaged and sprouted.*

Source: Pulse Australia (2016)

FEEDBACK

Figure 3: *Common quality defects of beans – insect-damaged and sprouted.*

Source: Pulse Australia (2016)

MORE INFORMATION

For more information see the Visual Recognition Standards Guide 2017/18 http://www.graintrade.org.au/fact-sheets-publications

12.2.3 Missed marketing opportunities

Early-harvested crops usually attract a premium price. By harvesting early growers have better control over how and when a crop is marketed. Those who harvest late are often price-takers in a falling market or may encounter delivery delays.

12.2.4 A more difficult harvest

Early harvesting also means there may be fewer summer weeds to clog the harvester, stain the seed or contaminate the sample.

Late-sown bean crops are more likely to carry pods close to the ground, especially if seeding rates were low. When pods are low the harvest comb needs to be set close to the ground to avoid grain loss. This will increase the risk of soil, sticks and stones contaminating the sample or damaging the header.

12.3 Plan ahead for successful early harvest

Harvesting early is not a choice that can be made at the last minute. It requires careful planning from the beginning of the season. There are three broad areas that contribute to a successful early harvest: sowing, in-crop management and harvest management.

Sowing

- Sow at the earliest opportunity but within the preferred planting window for your area. This may involve dry sowing by a particular calendar date.
- Use adapted varieties that meet your target for early harvesting.
- Moisture-seeking equipment and/or press-wheels can significantly enhance seeding opportunities under marginal soil moisture conditions.
- Using 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.

In-crop management

- Control native budworm during flowering to maximise early podset.

Harvest management

- Windrowing can enable earlier maturity and harvest date.
- Desiccation can be used to dry late maturing plants and green weeds.
- Be aware that chemicals used to desiccate or crop-top may reduce seed yield and quality.
- Set up the header to operate efficiently at 14–15% grain moisture content. High moisture harvesting can commence earlier in the season and earlier each day. Harvesting at 14% moisture content, as compared to 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. (See Section 12.13 Receival standards).

More information on windrowing, desiccation and crop-topping is in Section 11 Pre-harvest treatments. Information on managing weeds at harvest is in Section 7.4.6 Managing weeds at harvest.

12.4 Paddock preparation

The harvester will need to cut the stem below the lowest pod, which may be close to the ground. To minimise the risk of soil and other debris entering the harvester it may be worthwhile to roll the soil after sowing, to flatten and firm the soil and depress obstacles like stumps and stones. Harvest early while the crop stands more erect to minimise dirt, rocks and sticks entering the harvester.

When sowing wide rows, use inter-row sowing into standing stubble to encourage early erectness.[4] This means that the lowest pods will be higher, making for an easier harvest. Note that wide rows can also make the crop more vulnerable to lodging.

12.5 Moisture content and temperature

Harvest faba and broad bean as soon as the crop is ready. A black hilum is the best indicator of grain maturity. Harvest when the upper pods turn black and the stems are brittle enough to feed through the harvester. There are often a few green parts scattered in the crop.

The varied ripening of bean stalks within a bean canopy can create difficulties direct harvesting beans at the 14% moisture limit. Green bean stalks can be a greater problem in rotary harvesters as they wrap around rotors, reducing rotor speed and overloading rotor drives.

Aim for moisture levels up to 12—14% to avoid damage to the grain.

If the crop is left until it is too dry the lower pods will become prone to shattering and the grain vulnerable to cracking.

Harvest in humid conditions early in the day or into the evening, when pods are less prone to shatter. This can lead to more unthreshed pods in the grain sample. Also avoid harvesting in extreme heat when the grain is drier and more easily damaged.

Depending on how level the paddock is, it is unwise to harvest faba and broad bean at night, unless using a pick-up front or some positive height control that will stop the front from digging into the dirt. Some farmers have fitted wheels on the outer end of their fronts, as a depth stop. Others have bought ultra-sonic automatic depth controls to control header height.

4 Pulse Australia (2016) Wide row pulses and stubble retention. Pulse Australia, http://pulseaus.com.au/growing-pulses/publications/wide-rows-and-stubble-retention

FEEDBACK

12.6 Harvester set-up

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

The large seed of faba bean are prone to mechanical damage. It is better to take more care and prevent cracking, even if this means some grain is missed. A gentle harvest with a rotary harvester will generally cause less damage than the older style conventional harvester. The preferred harvester settings are listed in Table 1.

Table 1: A guide to harvester adjustments for faba bean.
Source: Lamb and Poddar (2008)

Reel speed:	slow	**Fan speed:**	high
Spiral clearance:	high	**Top sieve:**	32—38 mm
Thresher speed:	400—600 rpm	**Bottom sieve:**	16—19 mm
Concave clearance:	As wide as possible (e.g. 15—35 mm)	**Rotor speed (rotary machine):**	Depending on the model may be as low as 400—600 rpm, or up around 700—900 rpm

The pod height varies from 15—80 cm with pods held up in the canopy. Direct heading with crop lifters is possible, but should not be needed unless the crop is badly lodged, late-sown or drought affected.

Open-front or pick-up front machines will give the best result.[5] To reduce losses from vibration use double acting cutter bars and four finger guards with open second fingers (Photo 2).

On open-fronts, Vibra-mats can be used to improve the flow of cut material from the knife to the table augur especially in light crops. Plastic extension fingers fitted to the knife of a harvester can save significant losses for little financial outlay. Pods that would have fallen in front of the knife are caught on the fingers and pushed into the comb by the incoming crop (Photo 3).

If harvesting low and in uneven situations perforated screens may be used to remove the dirt before it enters the main working mechanism of the harvester.

Faba beans are easily threshed, so use a wide concave (15–35 mm). Try a concave setting fully open at the front, and half closed at the back.

Use a low thresher speed (400–600 rpm). Where there are a lot of summer weeds the speed may need to be increased to prevent blockages.

Use maximum wind and wide sieve or barley sieve settings. Bean seed is heavy compared to stem and leaf trash, so use draft to remove trash. Pulses are larger than wheat so a concave with many wires or blanked-off sections can stop grain separation. Alternating wires and blanking-off plates should be removed as they can prevent separation of large-seeded crops like faba bean.

The rake at the back of the sieve may need to be turned off to stop weeds entering the returns. Weeds blocking the walkers and sieves completely can lead to substantial grain losses.

5 T Weaver (2015) Profitable pulses – it's all about the harvest window. GRDC GroundCover™, Issue 118, September—October 2015, https://grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-118-sep-oct-2015/profitable-pulses-its-all-about-the-harvest-window

Photo 2: *Four finger guards with open second fingers will reduce vibration to limit damage during harvest.*

Photo: Pulse Australia via Weaver (2015)

Photo 3: *Extension fingers can be fitted to the knife to prevent pods from falling in front of the blade.*

Photo: Pulse Australia, via Weaver (2015)

Harvester modifications need to be carefully assessed as the benefits may not justify the costs. Some modifications that may be useful for pulse harvest include:

- Flexible cutter-bar fronts (flexi-fronts) are hinged in short sections allowing harvest close to the ground.
- Aussie-air directs a blast of air through the reel fingers for both light and heavy crops.
- Harvestaire replaces the reel with a manifold to direct a blast of air into the front and is more effective in light crops.
- Vibra-mat vibrates with the knife to prevent bunching on open front headers. It is cheap and most effective for light crops, but speed needs to be carefully managed.
- Crop lifters are a knife attachment designed to lift lodged crops. Height control is important as they can bring in more sticks and soil.
- Extension fingers are plastic fingers approximately 30 cm long that are fitted over existing fingers to prevent pods from falling in front of the knife.
- Extended fronts extend the distance between the knife and the auger to a maximum of 760 mm to minimise losses from bunching at the auger.
- Platform sweeps are used with extended fronts and are fingers that rake material towards the auger to minimise bunching. They can be used with conventional fronts.

FEEDBACK

- Draper fronts (e.g. MacDon and Honey Bee) have large clearances behind the knife and carry the crop to the elevator.
- Disrupter kits can be fitted to a rotary harvester to reduce cracked grain and rotor speed loss. They are more suitable for an early harvest and immature green bean stalks as the disrupter can crack mature bean stalks leading to higher grain losses.

12.7 Harvesting windrows

Pick-up fronts can be used to harvest windrowed faba and broad bean. They greatly reduce the amount of dirt entering the harvester and make harvesting easier because the harvesting height is not as critical. The fingers on the pick-ups are closely spaced and 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 cheap 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.

Crop lifters used close together on open fronts have been used with some success.

12.8 Lodged crops

Lodging can be an issue in good seasons when bean crops are tall or when sowing into wide rows.

If the crop has lodged it is usually best to harvest into the opposite direction, or at right angles, to the direction the crop has fallen. Crop lifters may help but have been known to dig in and bend the front. If 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.

MORE INFORMATION

GRDC Fact Sheet: Snail management www.grdc.com.au/GRDC-FS-SnailManagement

Booklet: *Bash 'Em, Burn 'Em, Bait 'Em*, https://grdc.com.au/GRDC-Snails-BashBurnBait

12.9 Managing snails

Snails can build up more rapidly in faba bean, field pea and canola compared with other crops.[6] They can clog up and damage harvesting machinery, causing delays while snail pulp is removed from sieves and other parts of the machinery. If allowed to dry, crushed snail guts and dust can set like concrete.

A rule of thumb is that snail numbers above 5/m^2 in pulses will contaminate grain at harvest.

Faba and broad bean receival standards require no more than 2 (whole or more than half) dead or alive snails per 400 grams. (See Section 12.13 Receival standards).

Snails need to be managed throughout the season using integrated management (see Section 8.3 Key pests of faba bean).

12.9.1 Plan ahead for harvesting crops with snails

Stop baiting 8 weeks before harvest to avoid bait contamination in grain. There is zero tolerance for bait contamination at delivery.

Plan for an early and strategic harvest. As the summer progresses snails are harder to dislodge from the canopy and are less likely to move down the canopy after light rain.

Leave badly infected areas until cool or damp weather when snails are more likely to be down off the plants.

6 GRDC (2012) Snail management Fact Sheet. GRDC, Southern and Western Regions, September 2012, https://grdc.com.au/GRDC-FS-SnailManagement

Windrow when cool and earlier in the season. Snails will invade windrows unless they are harvested early. Harvest windrows with an open front, fitted with crop lifters and PVC pipe covers to mask the unused width of the cutter bar.

12.9.2 Limiting intake of snails at harvest:

Header modifications and grain cleaning may be required to eliminate snail contamination in grain. These measures usually mean some grain will be lost. Harvester modifications require a trade-off between reduced throughput and increased grain losses.

- Use a dislodge bar about 2 m in front of the knife.
- Minimise the entry of dirt into the header by using a grate in the bottom of the front elevator.
- Increasing threshing intensity is not recommended as it will crush snails and damage grain.
- Scalp or screen: if there is a significant size difference you can scalp large snails and sieve smaller snails. Adjustable louvre sieves are suitable for faba bean.
- Use a smaller top sieve, or 10 mm punch hole or octagonal top sieve.
- Weld a lip onto the front of the top sieve to stop snails falling off.
- Add removable panels to the header to allow easy cleaning.
- Add a steel slat in the elevator to keep the elevator clean.
- Slow down the speed of the grain elevators.
- Loosen grain conveyor belts to allow them to stop before clogging and harvester damage occurs.
- Harvest with the repeat door open to prevent clogging where repeat ratios are high in snails and low in grain. Monitor grain losses as you move through different parts of the paddock.

Screens need to be cleaned regularly. Screens with large openings have quickly clogged with smaller beans and become ineffective (Photo 4). Screens with smaller openings are more effective in reducing snail and other contaminants in beans, but still need regular cleaning to maximise results.

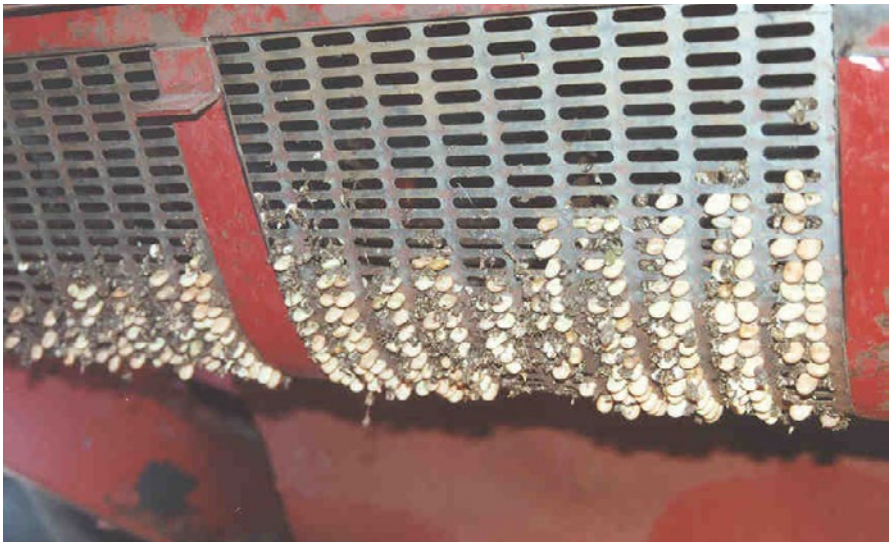

Photo 4: *Screen blocked by beans if opening is too large.*

Photo: M Richards, via Pulse Australia (2016)

Assess the size and spread of the snail population as the margins of the paddock are more likely to be heavily infested than the interior.[7] Harvest modifications such as a dislodger bar may only be required on the margins.

7 SARDI. Management in Crops and Pastures. SARDI, https://grdc.com.au/GRDC-Snails-BashBurnBait

FEEDBACK

Dislodger bars can remove snails but will result in some yield loss. Research has shown that a rigid bar fitted with dangling V-belts at 100 mm spacing can dislodge 60% of round snails with 2–3% grain loss. Dangling chains (450 g/m chains at 50 mm spacing) caused 85% dislodgement but 7% yield loss. A rotary brush used at low rpm brushing against the direction of travel can also be effective.

Dislodging is most suitable when windrowing crops or for crops which are harvested early. As the harvest season progresses the force required to dislodge snails from crops increases. In a 7-week period, a 7–10-fold increase in the dislodging force required to remove snails from a faba bean crop was recorded.

IN FOCUS

12.9.3 Post-harvest grain cleaning

Samples with high numbers of snails will require cleaning. These steps can remove high numbers of snails with very little grain loss:

- Scalping.
- Use a soft snail-crushing roller on faba bean of 14–15% moisture content and with a roller clearance of less than half the width of the seed.
- Screening.

Gravity separation may be effective for grain coming out of storage as dead snails are lighter in weight.

12.9.4 Post-harvest paddock management for snails

- Burning stubbles in autumn is effective if a complete burn of the paddock is achieved.
- Control grass along fence lines where snails can remain undisturbed.
- Roll, slash, cable or trash harrow stubbles so snails cannot get above 5 cm off the ground.
- Beware of erosion.

FEEDBACK

MORE INFORMATION

GroundCover™ article: Careful harvester set-up puts more grain in the bin, https://grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-95-november-december-2011/gc95-careful-harvester-setup

12.10 Assessing harvest loss

Grain can be lost at a number of places during harvest and each loss needs to be assessed so that corrective action can be taken. Grain can be lost:

- Before harvest (due to pod shedding, Figure 4(A)).
- At the harvester front (due to the front type or set-up, Figure 4(B)).
- In the thrashing system of the machine (due to drum, concave and sieve settings Figure 4(C)).

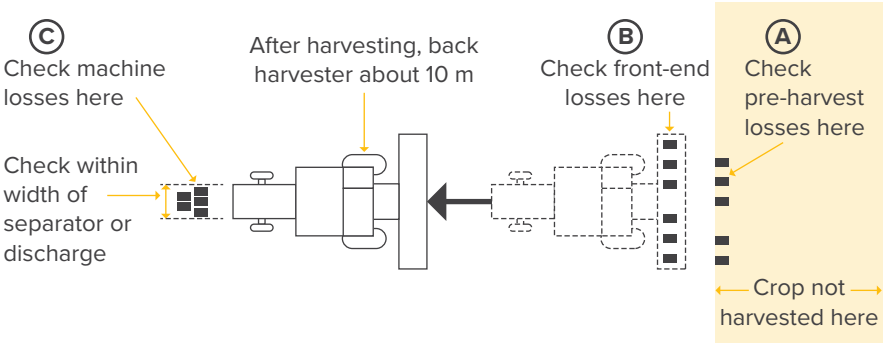

Figure 4: *Sampling places for estimating pre-harvest (A), front (B) and machine (C) losses.*

Source: The Chickpea Book, via Pulse Australia (2016) Southern faba & broad bean best management practices training course

To determine harvest losses:

1. Harvest a typical area without stopping the machine, then stop and allow the machine to clear itself of material.
2. Back the harvester about 10 m and shut down the machine.
3. Sample grain losses in each of the following three areas:
   - » pre-harvest (that is in the standing crop in front of the harvester 'A');
   - » front (in the cut crop in front of the harvester 'B'); and
   - » machine (in the cut crop behind the harvester including trash 'C').
4. Sampling is best done using a quadrat with an area of 0.1 m^2:
   - » count the number of seeds on the ground within the 0.1 m^2 quadrat. Ideally take 10 quadrats for each of the three locations (A, B and C); and
   - » average the number of seeds per 0.1 m^2 quadrat for each area. Multiply by 10 to get the number of seeds/m^2.

Grain losses on the ground can be estimated by counting the seed/m^2 and calculating the weight per hectare based on the 100 seed weight of your grain.

Example: A typical 100 seed weight of PBA Samira(ɸ) is 71 g/100 seeds

If the seed on the ground is 25/m^2

$$\text{Seed loss} = \frac{\text{No. of seed/m}^2 \times \text{100 seed weight}}{10}$$

$$= (25 \times 71)/10$$

$$= 177.5 \text{ kg/ha}$$

It is important to take a number of samples across the paddock.

FEEDBACK

MORE INFORMATION

GRDC booklet: *Reducing harvester fire risk: The Back Pocket Guide*, https://grdc.com.au/GRDC-BPG-ReducingHarvesterFireRisk

Pulse Australia: Avoiding harvester fires, http://pulseaus.com.au/blog/post/avoiding-harvester-fires

GroundCover™ article: A few steps to preventing header fires, https://grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-101/a-few-steps-to-preventing-header-fires

VIDEO

Watch GRDC video: Reducing the risk of harvester fires, https://youtu.be/WqTfR2ifM1I

12.11 Harvest fire risk

According to Kondinin Group research, an average of 7% of harvesters will start a fire each year.[8] Of these fires, around one in 10 will cause significant damage to the machine or the surrounding crop.

Chickpea and lentil crops have residue that has a higher fire risk than other crops.[9] Faba bean, field pea and lupin also have a fine residue that powders easily and creates a higher risk of ignition. Canadian advice suggests that diseased crop leaves have a higher risk of fire.

A 2010 report on harvester fires estimated that three-quarters of fires started in the engine bay, with the remainder resulting from failed bearings or brakes, electricals, rocks strikes, etc.[10] The key to avoiding harvester fires is regular and thorough cleaning and inspection, and to postpone work when conditions provide a high fire risk.

When harvesting pulses it is important to clean down with a high pressure air compressor more frequently than with cereals. Harvesters can be modified to provide easier access for regular cleaning.

12.12 Handling and moving faba bean

Faba and especially broad beans are a very large, plump grain and are very prone to mechanical damage during handling. This especially applies to:

- overly dry grain (<10% moisture content); and
- crops that have been exposed to weather damage prior to harvest.

More information is in Section 13 Storage.

8 GRDC (2013) Reducing harvester fire risk: The Back Pocket Guide. GRDC, https://grdc.com.au/GRDC-BPG-ReducingHarvesterFireRisk

9 Pulse Australia (2016) Avoiding harvester fires. Pulse Australia website, http://pulseaus.com.au/blog/post/avoiding-harvester-fires

10 G Quick (2010) An investigation into combine harvester fires. GRDC, Pulse Australia website, http://pulseaus.com.au/storage/app/media/blog%20assets/HARVESTER%20FIRES%20-%20Graeme%20Quick%20-%20Final%20Report.pdf

FEEDBACK

12.13 Receival standards

Table 2: Summary of National Faba bean receival standards Maximum moisture content (%)

	Maximum moisture content (%)	Minimum Purity (%)	Maximum defective plus poor colour (% by weight)	Screen size for defective (mm)	Poor colour maximum (%)	Foreign material maximum in total (%)
No 1 grade receival standard	14	97	6 includes: 3 Poor Colour; 3 total of all other defects except Mould	3.75 slotted	3 Includes ascochyta. Mould 1 per 400g	3
No 2 grade receival standard	14	97	10 includes: 7 Poor Colour; 3 total of all other defects	3.75 slotted	7 Includes ascochyta. Mould 1 per 400g	3
	Unmillable material maximum (%)	**Snail maximum**	**Insect maximum**	**Nominated weed seed maximums**		
No 1 grade receival standard	0.5 (0.3% soil)	2 per 400g	30 per 400g Grasshopper/locusts 4 per 400g	See receival standards appendix for amounts allowable		
No 2 grade receival standard	0.5 (0.3% soil)	2 per 400g	30 per 400g Grasshopper/locusts 4 per 400g	See receival standards appendix for amounts allowable		

Source: Compiled from national receival standards (2016/17)

Table 3: Summary of National Broad bean receival standards Maximum moisture content (%)

	Maximum moisture content (%)	Minimum Purity (%)	Maximum defective plus poor colour (% by weight)	Screen size for defective (mm)	Poor colour maximum (%)	Foreign material maximum in total (%)
No 1 grade receival standard CSP-2.1.1	14	97	7 Includes: 1.5 Insect Damaged 6 Mechanical Damage 3 Poor Colour 3 Ascochyta	6.0 mm slotted	3 Includes ascochyta. Mould 1 per 400g	3 including 0.5 max. unmillable
	Unmillable material maximum (%)	**Snail maximum**	**Insect maximum**	**Nominated weed seed maximums**		
No 1 grade receival standard	0.5 (0.3 soil)	2 per 400g	30 per 400g Grasshopper/locusts 4 per 400g	See receival standards appendix for amounts allowable		

Source: Compiled from national receival standards (2016/17)

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MORE INFORMATION

For receival standards, please see: http://www.pulseaus.com.au/marketing/receival-trading-standards

See the Visual Recognition Standards Guide 2017/18 http://www.graintrade.org.au/fact-sheets-publications

12.14 Grain Delivery

12.14.1 Faba bean

On delivery, faba bean types are segregated on variety type (based on seed size). Off-types or small sized beans become part of the defective count. The majority of deliveries continue to be into the Australian faba bean number 1 grade receival (CSP-5.2.1) which requires low insect damage and breakages (defectives 6% maximum) and minimal foreign material or impurities (3% maximum). Discolouration or seed staining of grain is a specified rejection in bean grades number 1 and 2 grades. Failure to achieve the required receival standard may mean price discounts at the discretion of the buyer or re-cleaning to make grade.

The Australian faba bean canning grade receival (CSP-5.1.1) may be applied by a few buyers who supply premium human consumption markets. This tighter receival grade requires minimal insect damage and breakages (defectives 2% maximum) and minimal discolouration or staining of grain (1% maximum). See pulse receival and export standards at http://www.pulseaus.com.au/storage/app/media/markets/20160801_Pulse-Standards.pdf.

Cash buying at harvest or warehousing options are not necessarily always available, close or desirable for faba bean growers at harvest. Depending on the location, variety/type, market outlet or grower choice, grain may need to be stored on farm. Sales must therefore be made privately to processors, agents or direct to the end-user.

Like with most pulse grains, there are bulk handling storage locations that handle faba bean grain for warehouse storage or storage on behalf of buyers. .There are also an increasing number of processors that receive faba bean at harvest or after storage. Bulk storage most likely will not be for all grades of faba beans or their grades. Receival grades are usually based on the national standards receival grade 1 farmer dressed (CSP-5.2.1).

See Section 12.13 Receival standards.

Delivery locations

Each year before harvest, bulk handling facilities usually publish a list of locations, segregations and grades of products that they will receive. These segregations reflect the national receival standard for faba bean as well as anticipated locations and volumes of production.

Glencore/Viterra in South Australia publish segregations they accept for faba bean each year pre-harvest. See http://www.viterra.com.au/index.php/classification/. Look for “grade segregations”, which are predominantly for medium sizes (“Fiesta types”), based on approved varieties of the appropriate medium size (eg Fiesta VF, Farah$^{\Phi}$, Nura$^{\Phi}$ and PBA Samira$^{\Phi}$).

Look also for “receival standards” which are updated annually pre-harvest. See http://www.viterra.com.au/index.php/receival-standards/.

Faba bean growers in Victoria and southern NSW likely will need to be in touch with the many private storage facilities and pulse processors direct. See a list at http://www.pulseaus.com.au/marketing/pulse-traders. Graincorp handle some faba beans at specified locations, but check for specific details. See www.graincorp.com.au/storage-and-logistics/.../technical-documents-and-information.

12.14.2 Broad bean and other faba bean classes

Broad bean, canning grade faba bean and larger sized faba beans (eg PBA Rana$^{\Phi}$, PBA Zahra$^{\Phi}$ will need specific arrangements with buyers or processors because bulk storage facilities for these types are usually unavailable or rare, unless traded as livestock feed. See a pulse trader list at http://www.pulseaus.com.au/marketing/pulse-traders.

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Broad beans on delivery to a processor are classified based on their size. They are then graded for sizing by the processor. Price paid and marketing is based on seed size classes. Grades are either to a mm size (eg greater than 14mm) or grains per 100 g (eg 65-70 grade).