SOUTHERN
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GRDC GROWNOTES™

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

FABA BEAN

SECTION 2

PLANNING AND PADDOCK PREPARATION

Planning and paddock preparation

Key points

- **Faba bean is a pulse crop most suited to the high and medium-rainfall zones of the southern region. Research is underway to expand the area of faba bean into the low-rainfall zone.**
- **The crop provides residual nitrogen, residual water and, when free of grass weeds, a disease break to boost yields of subsequent cereal crops.**
- **Faba bean prefers alkaline to slightly acid soils and cannot tolerate exchangeable aluminium in the soil, which is more common in acid soils. Do not grow faba bean in paddocks with Group B herbicide residues.**
- **Faba bean is typically sown with no-till into retained stubble but can be grown using a range of farming systems.**
- **The crop responds well to irrigation. Layout is one of the most important factors affecting irrigated faba bean yield.**
- **Several tools are available to estimate potential yield of faba bean to manage inputs effectively.**
- **Faba bean stubble can be grazed and is of high nutritional value to livestock, mainly due to spilt grain.**

2.1 Paddock selection

Faba bean is best suited to the medium and high-rainfall zones (400–550 mm annual average rainfall) as well as irrigated areas (Figure 1).[1 2]

Faba bean can be grown in drier areas or in dry seasons, but early sowing with suitable varieties may be needed to mitigate yield loss.[3]

Several new, early-flowering and maturing faba bean breeding lines are showing promise, with improved drought resistance. A faba bean variety trial in the Victorian Mallee focused on drought tolerance in the very dry season of 2015. A gross margin of $150/ha was achieved for the top-yielding breeding line, with $230/ha production costs at $450/t grain price, while modern commercial varieties gave very low or negative net returns.[4]

2.1.1 Paddock selection: key points

Assess the best paddock for faba bean based on past rotation, weed types, weed population, disease risk, herbicide use and soil type.[5]

The crop requires mild weather conditions during flowering to maximise yields.[6]

Faba bean is best suited to well-drained, deep and level soils with slightly acid or neutral to alkaline pH. The crop can be grown on more acidic soils where there is no exchangeable aluminium in the soil.[7] Soils should also have low levels of sodicity, salinity and boron, which can cause patchiness.[8]

Rough, rocky and uneven paddocks are not ideal for faba bean as harvest losses will be much higher where headers cannot cut at a low height.

Ideally, paddocks should be chosen well in advance to ensure good broadleaf weed control in the preceding crop and, if possible, the standing stubble left after harvest.[9] Paddocks with high weed burdens should be avoided as faba bean is only moderately competitive with weeds and broadleaf herbicide options are limited.

Be careful to avoid damage from herbicides used in the previous 24 months when planning to sow faba bean.

Faba bean is suited to paddocks that are likely to have a low nitrogen status, such as those with a longer cropping history. This will maximise the amount of nitrogen fixed by the plants.[10]

Faba bean crops should be sown at least 500 m from faba bean stubble to reduce the spread of Ascochyta blight. This recommendation extends to 1 km in areas where old stubble is prone to movement such as down slopes and flood plains.

Pay particular attention to controlling broadleaf weeds in the preceding crop.

1 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

2 J Carter (1999) Faba Bean and Broad Bean Growers Guide: A Guide for the Production of Faba Beans and Broad Beans. D Robey, M Raynes (eds.). Victoria Department of Natural Resources and Environment.

3 M Lines, L McMurray, J Paull, C Jeisman (2013) Faba bean varieties and management, 2012, Trials Results Book, MacKillop Farm Management Group, www.mackillopgroup.com.au/media/2012TrialBook/faba_beans.pdf

4 J Brand, L McMurray, C Walele, M Beveridge, M Rodda, J Paull (2016) Agronomy best practices with pulses – Victoria. GRDC Update Paper 23 February 2016.

5 J Carter (1999) Faba Bean and Broad Bean Growers Guide: A Guide for the Production of Faba Beans and Broad Beans. D Robey, M Raynes (eds.). Victoria Department of Natural Resources and Environment.

6 PIRSA (2000) Faba Bean Best Management Practice. Primary Industries and Regions SA Rural Solutions.

7 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

8 K Lindbeck (2014) Faba bean and chickpea disease management. GRDC Update Paper, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/07/Faba-bean-and-chickpea-disease-management

9 J Brand, L McMurray, C Walele, M Beveridge, M Rodda, J Paull (2016) Agronomy best practices with pulses – Victoria. GRDC Update Paper 23 February 2016.

10 J Brand, L McMurray, C Walele, M Beveridge, M Rodda, J Paull (2016) Agronomy best practices with pulses – Victoria. GRDC Update Paper 23 February 2016.

Faba bean yields can be improved by direct-drilling into standing cereal stubble.[11 12 13 14]

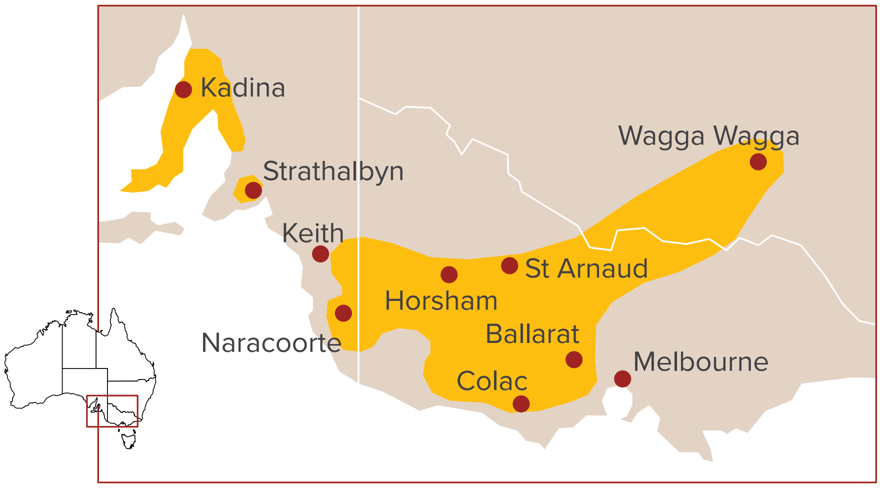

Figure 1: *Key requirements for faba bean in southern Australia.*

Source: Pulse Australia

2.1.2 Soil types

Soil structure

The ideal soil for faba bean is deep, well-structured loam to clay loam.

As faba bean tend to have shallow roots, the crop may suffer moisture stress in sandy soils that dry quickly (Photo 1). Faba bean are also not suited to sands (Photo 2) or infertile soils. Deep loams are considered the best soil for faba bean.[15 16 17]

Photo 1: *Faba bean suffers moisture stress in sandy soils that dry quickly.*

Photo: Felicity Pritchard

11 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

12 G Onus (2014) Optimising performance and managing risk in faba beans. GRDC Update Paper 26 August 2014, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/08/Optimising-performance-and-managing-risk-in-faba-beans

13 Pulse Australia (2014) Northern faba bean best management practices training course – 2014. Pulse Australia.

14 P Matthews, H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Agriculture, http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/beans/faba-bean

15 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

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

17 C Mullen (2004) The right pulse in the right paddock at the right time, Agnote DPI 446. W Noad (ed.). NSW Agriculture, http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/winter-crops/general-information/right-pulse

Photo 2: *Faba bean (centre) does not grow well on deep sands, in contrast to narrowleaf lupin.*

Photo: Alan Robson, Grain Legume Handbook (2008)

Although faba bean is very tolerant of waterlogging compared with other pulses,[18] a well-drained soil is preferred. Plant growth will be affected by prolonged waterlogging and foliar disease becomes more severe. Faba bean need good nodulation and disease control to survive extended waterlogging.[19 20]

Compacted soil layers, particularly on duplex soils, should be avoided.[21] Hard-setting soils also cause problems. Shallow, calcareous soils – particularly those on exposed limestone reef – can restrict growth (Table 1).

Table 1: Soil type effects on faba bean and broad bean growth.

Soil structure	Faba bean	Broad bean
Clay	Excellent	Excellent
Loam	Excellent	Excellent
Sand	Poor	Poor
Light sand	Very poor	Very poor
Clayed sand low lime)	Average	Poor
Clayed sand (free lime)	Average	Poor

Source: Grain Legume Handbook

Paddocks with a uniform soil type make management easier, as major variations in soil type can lead to uneven ripening of the crop. This can delay harvest, which increases the risk of weather damage and losses from cracking and split grain.

18 M Lines, L McMurray, J Paull, C Jeisman (2013) Faba bean varieties and management, 2012, Trials Results Book, MacKillop Farm Management Group, www.mackillopgroup.com.au/media/2012TrialBook/faba_beans.pdf

19 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

20 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

21 Topcrop Australia (undated) Checklist for a successful faba bean crop. Topcrop Australia and Victoria Department of Natural Resources and Environment.

Uneven ripening also complicates the timing of insecticides, desiccants and fungicides (see Section 11 Pre-harvest treatments for more information).[22]

Faba bean may fail to nodulate on acidic soils with high aluminium, particularly if they are hard-setting or waterlogged.[23] Inoculation with granular inoculum can assist faba bean nodulation on some acid soils (see Section 4 Planting for more information).

Soil pH

Faba bean prefers slightly acid to alkaline soils but can tolerate acid soils with no exchangeable aluminium. Faba bean prefers slightly acid to alkaline soils ranging in pH ($CaCl_2$) from 5.2 to 8.0, with no exchangeable aluminium.

Consider applying lime if pH in the topsoil is less than 5.2 ($CaCl_2$) Avoid growing faba bean on paddocks with acid soil at depth, that is with pH ($CaCl_2$) less than 5.2 at 20–30 cm.[24 25 26]

Hostile soils

Growers considering faba bean on acidic soil should check aluminium and manganese levels are not within the toxic range for faba bean; the crop has low tolerance for soil aluminium.[27]

Faba and broad bean are moderately susceptible to hostile subsoils. Boron toxicity and possibly salinity can cause plants in affected areas to die.[28]

Sodic soils should be avoided.[29] A soil with an exchangeable sodium percentage (ESP) of >5% exchangeable sodium is considered sodic. Faba bean is suited to soils with an ESP below 5 in the top soil and 10 in the subsoil
(see Section 6 Nutrition and Fertiliser for more information).[30]

Evenness of soil surface

An even soil surface is important to make harvesting easier (see Section 2.5 Seedbed requirements for more information).

2.1.3 Paddock selection to reduce disease risk

Paddock selection can reduce the risk of faba bean diseases.[31]

A 4-year, or more, break between faba bean crops is recommended. Avoid sowing the crop adjacent to faba bean stubble, particularly downwind. If possible, separate the faba bean crop from the previous year's faba bean stubble by at least 500 m.[32]

Avoid, where possible, sowing faba bean adjacent to vetch crops or stubble, which may harbour the fungus *Botrytis fabae*, the primary cause of chocolate spot in faba bean (see Section 9 Diseases for more information).

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22 Pulse Australia (2014) Northern faba bean best management practices training course – 2014. Pulse Australia.

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

24 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

25 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

26 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

27 Pulse Australia (2014) Northern faba bean best management practices training course – 2014. Pulse Australia.

28 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

29 P Matthews, H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Agriculture, http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/beans/faba-bean

30 C Mullen (2004) The right pulse in the right paddock at the right time, Agnote DPI 446. W Noad (ed.). NSW Agriculture, http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/winter-crops/general-information/right-pulse

31 K Lindbeck (2014) Faba bean and chickpea disease management. GRDC Update Paper, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/07/Faba-bean-and-chickpea-disease-management

32 Pulse Australia (2014) Northern faba bean best management practices training course – 2014. Pulse Australia.

Ensure that the maximum plant-back periods for herbicides are adhered to, particularly for sulfonylurea herbicides and clopyralid; herbicide residuse may cause significant crop damage and weaken plant's ability to resist disease (see Section 2.4 Herbicide residue management for more information).

2.1.4 Paddock selection based on weed status

Faba bean should not be sown in paddocks with moderate to high levels of broadleaf weeds, as there are few chemical control options. Generally, grass weeds can be readily controlled in faba bean crops.[33] Australian faba bean breeding lines with Group B herbicide tolerance are being assessed.[34] [35]

Herbicide-resistant grass weeds can cause major problems in faba bean. A careful management strategy of resistant weeds must be in place well in advance of sowing.

While it may be possible to reduce the weed burden in the season and summer before sowing faba bean, it is best to avoid paddocks with specific weeds that cannot be controlled by herbicides.[36]

2.2 Paddock history and rotation

Pulses play an important, complementary role in crop rotations/sequences[37] by enabling better management of weeds, diseases, herbicide residues and soil nitrogen.

While the most suitable rotation requires careful planning, there are no set rules and a separate rotation should be devised for each cropping paddock. The main aims should be sustainability and the highest possible long-term profit.

To achieve these, the rotation must be flexible enough to cope with key strategies such as maintaining soil fertility and structure, controlling crop diseases, and controlling weeds and their seedset.

Recent research in Victoria and southern New South Wales showed that canola and pulse crops were frequently as profitable and, in some cases, considerably more profitable, than wheat. Further, wheat following break crops was consistently more profitable than wheat on wheat.[38]

Faba bean is usually grown after a winter cereal.[39] Growers are frequently adopting a continuous pulse/cereal/oilseed/cereal sequence, such as faba bean/wheat/canola/barley.[40] Alternatively, an increasing number of growers are now using a double-break rotation of a pulse followed by canola to provide an additional weed and disease break before returning to a cereal crop.

Successive cropping with the same pulse is likely to result in a rapid build-up of root and foliar diseases and weeds. Take extreme care if growing the same crop in the same paddock without a break of at least 3 years. Where possible, alternate different pulse crops in a continuous rotation with cereals.

33 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

34 M Lines, L McMurray, J Brand, A Ware, J Davidson, R Kimber, J Paull, K Hobson (2014) Pulse varieties and agronomy update (Adelaide). GRDC Update Paper 25 February 2014, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/02/Pulse-varieties-and-agronomy-update-Adelaide

35 D Mao, J Paull, C Preston, S Ying Yang, T Sutton, L McMurray (2016) Developing improved herbicide tolerance in pulse crops. GRDC Update Paper 9 February 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Developing-improved-herbicide-tolerance-in-pulse-crops

36 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

37 Grain Legume Handbook Committee (2004) The role of pulses. Grain Legume Handbook. J Lamb, A Poddar (eds.) Grain Legume Handbook Committee.

38 M Peoples, T Swan, L Goward, J Hunt, A Glover, I Trevethan, A Pratt (2015) Key outcomes arising from the crop sequence project. GRDC Grains Research Update Paper 19 February 2015, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/02/Key-outcomes-arising-from-the-crop-sequence-project

39 G Onus (2014) Optimising performance and managing risk in faba beans. GRDC Update Paper 26 August 2014, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/08/Optimising-performance-and-managing-risk-in-faba-beans

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

Faba bean fits well into stubble-retention systems. Compared with wheat, the sowing window for faba bean is relatively early, which can assist in spreading out operations and labour requirements, particularly if the crop is dry-sown (see Section 2.3 Stubble and summer weed management for more information).

Growing faba bean within a cereal-based rotation requires minimal additional machinery, although slight machinery adjustments may be required to handle the larger seed size.

In high-rainfall areas, faba bean provide a new rotation option and opportunity to generate income from paddocks where wet conditions rule out other winter grain crops.

Faba bean may also be sown as an opportunity crop in low-rainfall areas and still produce economic yields; summer rainfall must be sufficient to provide a full moisture profile before planting. Stubble retention is highly beneficial in this situation.[41]

2.2.1 Rotational benefits of pulses

A survey of scientific research from across the world has revealed that the average yield increase of wheat after a break crop is about 20%.

The reasons for this include:

- improved weed control;
- improved residual water and nitrogen supply;
- cereal root disease control;
- effects on soil biology and structure; and possibly
- allelopathy (the chemical inhibition of one plant by another).[42]

Importantly, the benefits of pulses and other break crops/pastures can only be captured if break crops are managed well.

A weedy, low-yielding pulse or canola crop is not really a 'break' crop, as weeds will host cereal diseases and set seeds that emerge in subsequent cereal crops. Nitrogen fixation by the legumes will also be poor.[43]

Yield gains in subsequent crops

A recent review of more than 900 experiments has quantified the yield benefits delivered by break crops.

When compared with wheat on wheat, wheat yields after a break crop increased on average by:

- 1.0 t/ha following pulses (ranging from 0.7–1.6 t/ha);
- 0.8 t/ha following canola; and
- 0.5 t/ha following oats.

Although the yield benefit was variable, yield was rarely reduced. The average yield benefit was also constant across the full range of wheat yield, whether 1.0 t/ha or 6.0 t/ha.

This 'break-crop effect' often extended to a second wheat crop in the sequence, especially following legumes (a benefit of 0.2–0.3 t/ha), but rarely to a third crop, except under dry conditions.[44]

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41 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

42 J Kirkegaard, O Christen, J Krupinsky, D Layzell (2008). Break crop benefits in temperate wheat production. Field Crops Research 107. pp 185–195.

43 J Kirkegaard (2015) Grain legumes can deliver an extra 1t/ha yield to wheat crops. GroundCover Supplement Issue 115 March–April 2015. Grains Research and Development Corporation, https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/Ground-Cover-Issue-115-Profitable-pulses-and-pastures/Grain-legumes-can-delivery-an-extra-1tha-yield-to-wheat-crops

44 J Kirkegaard (2015) Grain legumes can deliver an extra 1t/ha yield to wheat crops. GroundCover Supplement Issue 115 March–April 2015. Grains Research and Development Corporation, https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/Ground-Cover-Issue-115-Profitable-pulses-and-pastures/Grain-legumes-can-delivery-an-extra-1tha-yield-to-wheat-crops

FEEDBACK

The individual factors contributing to the yield gains in cereal crops after break crops have been assessed. The most important components were found to be the suppression of the cereal disease take-all and the contribution of soil nitrogen by legume crops. These two factors were each estimated to increase the yield of a 4 t/ha wheat crop by 0.5 t/ha.

Financial benefits over the rotation

The financial benefit of well-managed break crops to subsequent cereal crops is an important reason for growers to choose to sow pulses or other break crops, especially where break crops are considered more risky or less profitable than the main cereal crop.

Consider the economic benefits of break crops over a full 2–3-year cropping sequence, rather than just the year in which it is grown.

Another important benefit of break crops is having a diversified grains income to manage price variations.[45 46]

Managing weeds including herbicide-resistant weeds

Break crops form part of the integrated management of weeds, including herbicide-resistant weeds.

The prevalence of herbicide-resistant weeds (especially annual ryegrass) due to intensive cereal production with selective herbicides now dictates crop sequence decisions for many growers.[47] One of the main reasons for southern region growers to switch from a cereal to a break crop is the availability of more herbicide options to manage difficult weeds.[48]

Random sampling of paddocks in southern NSW, South Australia and Victoria has revealed widespread resistance or partial resistance to a broad range of herbicide groups (up to 70–80% of samples in some areas).[49 50]

Faba bean is moderately competitive against weeds in its early stages, depending on plant population and row spacing. Crop-topping to prevent weed seedset is possible in many situations – except in long growing seasons and in late-maturing varieties.[51]

Nitrogen fixation

Faba bean plants fix their own nitrogen and may contribute a significant amount of additional soil nitrogen, which is available for following crops to use.[52] However, normally high soil nitrogen following a pulse crop is a result of residual nitrogen carrying over, rather than a net gain from the pulse crop.

While pulses can usually fix sufficient nitrogen from the air for their own needs, a large amount is removed in the grain during harvest.

MORE INFORMATION

Inoculating legumes: A practical guide, https://grdc.com.au/GRDC-Booklet-InoculatingLegumes

45 J Kirkegaard (2015) Grain legumes can deliver an extra 1t/ha yield to wheat crops. GroundCover Supplement: Profitable pulses and pastures (issue 115), https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/Ground-Cover-Issue-115-Profitable-pulses-and-pastures/Grain-legumes-can-delivery-an-extra-1tha-yield-to-wheat-crops

46 J Angus, M Peoples, J Kirkegaard, M Ryan, L Ohlander (2008) The value of break crops for wheat. Proceedings 14th Conference, Australian Society of Agronomy, Adelaide, SA. Australian Society of Agronomy, www.regional.org.au/au/asa/2008/concurrent/rotations/5786_angusjf.htm

47 J Sabburg, G Allen (2013) Seasonal climate outlook improvements changes from historical to real time data. GRDC Update Paper 18 July 2013, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/07/Seasonal-climate-outlook-improvements-changes-from-historical-to-real-time-data

48 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

49 J Broster, E Koetz, H Wu (2011) Herbicide resistance levels in annual ryegrass (Lolium rigidum Gaud.) in southern New South Wales. Plant Protection Quarterly 26 (1). pp 22–28.

50 C Preston, P Boutsalis, S Kleeman, R Saini, G Gill (2013) Maintaining the best options with herbicides Maintaining the best options with herbicides. GRDC Update Paper, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/08/Maintaining-the-best-options-with-herbicides

51 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

52 M Lines, L McMurray, J Paull, C Jeisman (2013) Faba bean varieties and management, 2012, Trials Results Book, MacKillop Farm Management Group, www.mackillopgroup.com.au/media/2012TrialBook/faba_beans.pdf

A well-grown pulse crop that yields poorly due to a harsh seasonal finish can provide a net increase in soil nitrogen levels. In low-yielding cereal/pulse rotations, the pulse may provide enough nitrogen for the following crop.

In contrast, an average or high-yielding pulse crop often removes at least as much nitrogen in the grain as it produces through fixation. After a pulse crop, the soil nitrogen level is not usually depleted.[53]

A field trial comparing faba bean, chickpea and wheat revealed that faba bean is more dependent on fixed nitrogen than chickpea in its early stages; faba bean needs early and effective nodulation.

Faba bean fixed 3.5 times more nitrogen than chickpea (57 kg/ha compared with 16 kg/ha) and used almost half the soil nitrogen (69 kg/ha compared with 118 kg/ha) (Figure 4). Soil nitrogen balance (combined crop-fixed nitrogen as inputs and grain nitrogen as outputs), was positive for the pulses (79 to 157 kg/ha for faba bean) but negative for wheat (–22 to –66 kg/ha). Despite this, soil nitrate levels in the wheat, faba bean and chickpea plots did not differ at the end of the season.[54]

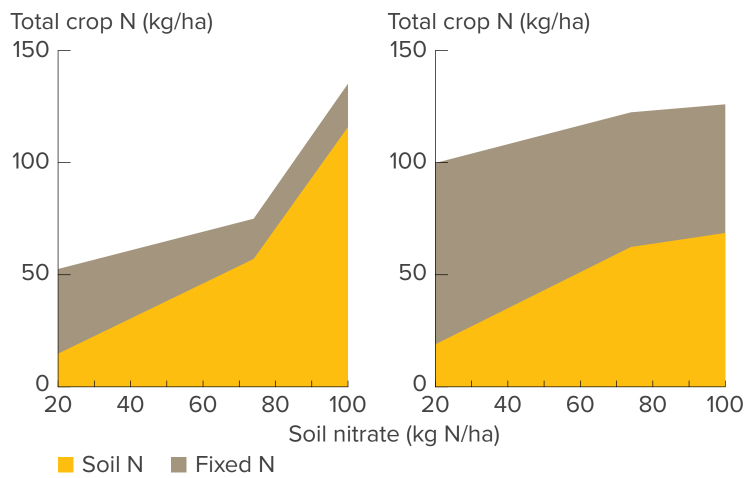

Figure 2: *Faba bean fixed 3.5 times more nitrogen than chickpea (left) (57 kg/ha compared with 16 kg/ha) and used almost half the soil nitrogen (69 kg/ha compared with 118 kg/ha).*

Source: J Turpin, D Herridge, M and Robertson (2002)

Various studies undertaken in SA, Victoria and southern NSW have compared inputs of fixed nitrogen by pulses grown for grain or brown manure and pure legume pastures either cut for hay or grazed. Brown-manured crops and forage legumes generally provided higher net returns of fixed nitrogen to soils than grain crops, since large amounts of nitrogen were removed in the pulse grain at harvest. Different legume species also have different potential for growth and nitrogen fixation, regardless of their end use.[55]

After a pulse crop, the nitrogen-rich residues break down rapidly. Most of this organic nitrogen is readily available to the following crop.

Residual water

The shallow root system, combined with a shorter growing season, means that soil moisture at depth is not fully extracted, potentially providing residual available water for subsequent crops.

53 Grain Legume Handbook Committee (2004) The role of pulses. Grain Legume Handbook. J Lamb, A Poddar (eds.) Grain Legume Handbook Committee.

54 J Turpin, D Herridge, M and Robertson (2002) Nitrogen fixation and soil nitrate interactions in field-grown chickpea (*Cicer arieinum*) and faba bean (*Vicia faba*). Crop and Pasture Science 55(5). pp 599–608.

55 J Kirkegaard, O Christen, J Krupinsky, D Layzell (2008). Break crop benefits in temperate wheat production. Field Crops Research 107. pp 185–195.

Cereal disease management

Grass-free pulse crops are generally effective disease breaks, usually more so than pastures due to the potential of grasses to provide alternate hosts for diseases.[56]

Faba bean is a pulse break crop that can be used in rotations to effectively break the life cycle of cereal root diseases such as take-all, crown rot, root-lesion nematode and cereal cyst nematode.[57]

Take-all

In southern Australia, much of the yield benefit in well-fertilised dryland wheat crops as a result of including break crops has been attributed to control of take-all.[58 59]

All grass-free pulse and oilseed crops can provide a disease break from take-all. Remove grass weeds from faba bean before the end of July (or the end of June in the Mallee) to prevent the fungus multiplying and being carried into the next crop.[60]

Crown rot

For crown rot, a 2-year break with a non-susceptible crop such as faba bean can reduce the severity of crown rot on subsequent wheat or barley crops. Break crops allow for the natural decomposition of cereal residues, which harbour the crown rot fungus.

Root-lesion nematode

Root-lesion nematode (RLN) is another important cereal disease that can be managed with the inclusion of faba bean in the rotation. At least 1 in 5 cropping paddocks in south-eastern Australia have enough RLN to reduce yield.

Faba bean, field pea and lentil are useful in crop rotations as they are poor hosts of the two important species that are common in southern region cropping soils: *Pratylenchus thornei* and *P. neglectus* (Table 2). The two species often occur together (see Section 9 Diseases for more information).

Rotations are the best way of controlling RLN. Resistant crops can potentially halve nematode populations each year. A 2-year break (or longer) from susceptible crops may be necessary to minimise yield loss if nematode numbers were high to begin with.[61] (See Section 2.8 Nematode status for more information).

Table 2: Hosting abilitty of various crops of two important RLN species. Faba bean is a poor host of the two important root-lesion nematode species, making it a particularly useful crop in rotations.

Crop	*P. thornei*	*P. neglectus*
Faba bean	Poor	Poor
Barley	Poor to intermediate	Poor to intermediate
Canola	Intermediate	Good
Field pea	Poor	Poor
Lentil	Poor	Poor
Vetch	Good	-

Note: In some crops the hosting ability varies between varieties.
Source: G Hollaway (2013) Cereal root diseases, Agnote AG0562. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/cereal-root-diseases

56 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

57 G Hollaway (2013) Cereal root diseases, Agnote AG0562. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/cereal-root-diseases

58 J Kirkegaard, O Christen, J Krupinsky, D Layzell (2008). Break crop benefits in temperate wheat production. Field Crops Research 107. pp 185–195.

59 J Kollmorgen, J Griffiths, D Walsgott (1983) The effects of various crops on the survival and carry-over of the wheat take-all fungus *Gaeumannomyces graminis* var. *tritici*. Plant Pathology 32. pp 73–77.

60 G Hollaway (2013) Cereal root diseases, Agnote AG0562. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/cereal-root-diseases

61 G Hollaway (2013) Cereal root diseases, Agnote AG0562. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/cereal-root-diseases

VIDEO

Watch a video from SANTFA about burning snails and weed seeds: https://youtu.be/zqQKFFqndKQ

Cereal foliar disease

Break crops can also play a role in cereal foliar disease management. None of the main leaf or stem diseases of wheat can be hosted by grass-free faba bean or other pulse crops or oilseeds.[62]

Fusarium head blight can also be reduced with a 1–2-year non-host crop, such as faba bean.[63]

2.2.2 Rotational disadvantages of pulses

Faba bean is susceptible to fungal diseases such as Ascochyta blight and chocolate spot and will require several fungicide applications during the season.

While the crop has few disadvantages, a tall faba bean crop usually needs to be sprayed with a high-rise, self-propelled boom sprayer or aerial sprayer late in the season.[64]

Unlike canola or safflower, faba bean does not have an extensive, deep root system to break up hardpans and create channels in the soil profile to facilitate air and water movement.

Faba bean and broad bean are moderately susceptible to hostile subsoils. Boron toxicity, sodicity and possibly salinity can cause plants in affected areas to die. Faba bean and broad bean have a low tolerance for exchangeable aluminium.[65]

While faba bean has sometimes struggled to provide a financial return as a 'stand-alone' crop, relative to other crops, new varieties, better disease control and modern agronomic practices have improved this situation. Growers also need to consider the beneficial impact of faba bean on subsequent cereal yields and weed control options even if the faba bean crop performs poorly.[66]

Faba bean, like other pulses, provides limited stubble cover, increasing the risk of soil erosion.[67] This is especially so if stubble had not been retained at sowing.

2.3 Stubble and summer weed management

Direct-drilling and stubble retention, GPS guidance and controlled-traffic farming are some of the factors supporting more intense crop production with the inclusion of pulses, compared with traditional pasture/cereal farming systems.[68]

Case studies of southern NSW growers highlight how faba bean crops and other pulses can be successful using a range of farming systems.[69]

Traditionally, faba bean paddocks are prepared using conventional or minimum cultivation, similar to other winter crops. Faba bean paddocks are typically sown using no-till methods into retained stubble, although some soils may require cultivation before sowing to remove hardpans.

Maintaining stubble will maximise yield potential. It makes harvesting faba bean easier, as pod height is increased.[70]

62 GRDC (2011) Break crop benefits fact sheet. Grains Research and Development Corporation, https://grdc.com.au/resources-and-publications/all-publications/factsheets/2011/03/break-crop-benefits-west

63 D Herridge (2011) Managing legume and fertiliser N for northern grains. Grains Research and Development Corporation.

64 GRDC (2014) Planning/Paddock preparation., GrowNotes™: Faba Beans (northern region). Grains Research and Development Corporation, https://grdc.com.au/Resources/GrowNotes™

65 Pulse Australia (2016) Best management guide. Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

66 Grain Legume Handbook Committee (2004) The role of pulses. Grain Legume Handbook. J Lamb, A Poddar (eds.) Grain Legume Handbook Committee.

67 GRDC (2014) Planning/Paddock preparation., GrowNotes™: Faba Beans (northern region). Grains Research and Development Corporation, https://grdc.com.au/Resources/GrowNotes™

68

69 E Armstrong, D Holding (2015) Pulses Putting life into the farming system: An insight from growers who are making pulses work. NSW Department of Primary Industries, www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/general/pulses-farming-system

70 J Brand, L McMurray, C Walele, M Beveridge, M Rodda, J Paull (2016) Agronomy best practices with pulses – Victoria. GRDC Update Paper 23 February 2016.

Harrowing, slashing or burning are options where stubble loads are too heavy, or where the stubble has been disturbed by grazing and stubble-handling equipment is unavailable[71]. Strategic burning of some cereal stubbles may allow hassle-free sowing and some control of weed seeds and stubble-borne cereal diseases.[72] Disc seeders are now more commonly being used for sowing into retained cereal stubble.

2.3.1 Stubble management

Photo 3: *Faba bean crops sown into cereal stubble establish well and may have lower soil evaporation than when sown into bare soil.*

Photo: Wayne Hawthorne, formerly Pulse Australia

Managing stubble after cereals should start during the cereal harvest, making sure that straw is left about 30 cm in height. Ideally, damage to stubble should be minimised by restricting all traffic, including chaser bins and boom sprays, to tramlines or permanent wheel tracks.[73]

Retaining stubble can provide many benefits, particularly in drier climates. These include better water infiltration and slower moisture loss from evaporation, potentially ensuring that more moisture is captured and stored in the soil. It can also help to retain some deep soil moisture left from summer rains, if weeds are controlled.

Retaining stubble may provide the opportunity for earlier sowing compared with burning stubble, due to preservation of soil moisture near the surface. Some pulse growers have been able to produce a pulse crop in drought years by retaining stubble, allowing earlier sowing, sometimes with wider rows spacing. These have led to crops that are taller at harvest with less lodging.[74]

In the low-rainfall zone, moisture conservation techniques, including stubble retention, will allow faba bean to be included in farming systems in the future (Photo 5). Potential breeding lines with early flowering and early maturity are achieving much higher yields than modern varieties in very dry conditions.[75]

MORE INFORMATION

GRDC 2011 Stubble management Fact Sheet https://grdc.com.au/Resources/Factsheets/2011/03/Stubble-Management

VIDEO

SANTFA video: Stubble management https://youtu.be/hjJ5HtyLluU

71 P Matthews, H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Agriculture, http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/beans/faba-bean

72 E Armstrong, D Holding (2015) Pulses Putting life into the farming system: An insight from growers who are making pulses work. NSW Department of Primary Industries, www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/general/pulses-farming-system

73 P Matthews, H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Agriculture, http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/beans/faba-bean

74 GRDC (2011) Break crop benefits fact sheet. Grains Research and Development Corporation, https://grdc.com.au/resources-and-publications/all-publications/factsheets/2011/03/break-crop-benefits-west

75 J Brand, L McMurray, C Walele, M Beveridge, M Rodda, J Paull (2016) Agronomy best practices with pulses – Victoria. GRDC Update Paper 23 February 2016.

Sowing directly into standing cereal stubbles can be a part of an integrated pest management strategy against aphids. Bare soil is more attractive to some aphid species, which transmit viruses to pulse crops (see Section 8 Pest management for more information).

Table 3: Effect of stubble retention and fungicide treatments on faba bean grain yield (t/ha) at Rupanyup and Lake Bolac, Victoria, in 2011.

	Grain yield (t/ha)			
	Rupanyup, Wimmera, Victoria (medium-rainfall zone)		Lake Bolac, Western District, Victoria (high-rainfall zone)	
	Standing stubble*	Burnt stubble*	Slashed stubble*	Burnt stubble*
Total disease control, (fortnightly carbendazim + chlorothalonil)	4.7	3.9	3.2	3.4
Carbendazim x 3 (early, mid, late flowering)	4.5	3.7	3.1	3.2
Carbendazim x 2 (early and late flowering)	4.1	3.4	2.85	3.05
Nil fungicide	3.5	3.0	2.5	2.65
Least significant difference (same site, same stubble treatment)	0.21	0.22	0.21	0.23

* Separate but adjacent trials for stubble treatments.

Source: Jason Brand, Agriculture Victoria, Southern Pulse Agronomy

Trials held in the Wimmera and Western District of Victoria compared faba bean disease treatments on separate trials with burnt stubble and standing stubble or burnt and slashed stubble (Table 3).

Results at Rupanyup (Wimmera) suggest large yield differences between stubble treatments. Maturity of the plots in the standing stubble was up to 2 weeks later than the burnt stubble. Response to fungicide regimes across varieties was relatively similar in both trials at the Wimmera site. The average height to the lowest pod in standing stubble (32.3 cm) was more than in the burnt stubble (26.1 cm).

In contrast, at Lake Bolac, the high-rainfall site, summer rainfall provided a full soil moisture profile at sowing. Consequently, stubble retention appeared to have little effect on faba bean yield. While faba bean yields were slightly higher on burnt stubble, disease levels were also higher than on slashed stubble. Disease, predominantly rust, resulted in grain yield losses of between 5% and 35%, depending on variety.[76]

2.3.2 Wide rows with retained stubble

Row spacing in faba bean – and any other crop – is about the whole farming system, and row spacing per se cannot be looked at in isolation.

Faba bean growers in southern Australia are finding success with wide row and skip row sowing (30–54 cm), particularly in low-yielding seasons. Retaining stubble (preferably standing) and good weed control is essential with wide rows.[77] [78]

For faba bean, wide row cropping with stubble retention may provide several benefits:

- confidence to sow earlier with less problems with disease and podset;
- better stubble clearance and easier sowing;
- management of weeds by minimal soil disturbance;

76 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

77 W Hawthorne (2015) Wide row pulses and stubble systems. Australian Pulse Bulletin. Pulse Australia, www.pulseaus.com.au/growing-pulses/publications/wide-rows-and-stubble-retention

78 S Kleeman, G Gill (2008) Wide row cropping for weed management opportunities. GRDC Update Paper 20 June 2008, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2008/06/Widerow-cropping-for-weed-management-opportunities

FEEDBACK

MORE INFORMATION

GRDC 2011 Crop placement and row spacing Fact Sheet https://grdc.com.au/Resources/Factsheets/2011/02/Crop-Placement-and-Row-Spacing-Southern-Fact-Sheet

Australian Pulse Bulletin: Wide row pulses and stubble retention www.pulseaus.com.au/growing-pulses/publications/wide-rows-and-stubble-retention

- less rain-splash diseases (Cercospora and Ascochyta) early in the season, when the crop is sown into stubble;
- delayed canopy closure, allowing later initial fungicide application;
- better early podset in lush growth conditions;
- easier access for pollinators (such as native bees);
- early erectness if sowing inter-row into standing stubble, even at 50 or 60 cm row spacing (note the crop may lodge later if the crop is dense and the stubble is tall);
- lowest pods are higher, so they are easier to harvest; and
- improved water use efficiency.

A trial at Roseworthy, SA, in 2006 showed that increasing row spacing from 18 to 36 cm significantly increased Fiesta VF faba bean yields by 24% in a low-yielding (drought) season (Table 4). Yields at the 54 cm spacing were also 20% higher than at 18 cm. In this low-yielding trial, yields significantly improved with wider rows, compared with 18 cm spacing ($P < 0.05$). Good weed control is imperative with wide rows. With wider rows, water use was deferred from the vegetative to the reproductive phase, contributing to better pod retention and yield.[79 80]

Table 4: Faba bean yield response to row spacing, Roseworthy, South Australia, 2006.

Row spacing (cm)	Yield (t/ha)
18	0.79
36	0.98
54	0.95

Note: coefficient of variation (CV) and least significant difference (LSD) not available. Good weed control is imperative.

Sources: S Kleeman, G Gill (2008) Wide row cropping for weed management opportunities, GRDC Update Paper 20 June 2008; GRDC Crop placement and row spacing fact sheet

In contrast to the Roseworthy trial, faba bean at a higher-yielding site at Hart, SA, in 2009 produced much higher yields with 22 cm spacing compared with 45 cm spacing, with or without standing stubble (Table 5). Faba bean on wide rows performed better with standing stubble than without, whereas stubble made no difference to yields of faba bean on narrow rows (note that there was only light stubble present in the trial). Loss of soil moisture through evaporation where there is insufficient groundcover is an important issue to consider in wide-row faba bean.[81]

Table 5: Grain yield of Farah$^{\phi}$ faba bean with two row spacing and stubble treatments, Hart, South Australia, 2009.

Row spacing (cm)	Stubble removed (slashed)	Stubble standing
22.5	3.31 ab*	3.42 a
45	2.23 f	2.64 cde

*Different letters indicate significantly different yields. CV and LSD not available.
Source: Hart Field Site, South Australia, 2009

Weed control is imperative with wide-row cropping. A second trial at Roseworthy revealed that, without weed control, faba bean grown on wide rows could not compete with annual ryegrass (189 plants/m^2) and produced extremely low yield (0.16 kg/ha) (see Section 7 Weed Control for more information).

In the second Roseworthy trial, faba bean sown in 54 cm rows yielded 1.05 t/ha, compared with 0.68 t/ha with 18 cm rows, when weeds were controlled post-sowing,

79 S Kleeman, G Gill (2008) Wide row cropping for weed management opportunities. GRDC Update Paper 20 June 2008, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2008/06/Widerow-cropping-for-weed-management-opportunities

80 GRDC (2011) Crop placement and row spacing fact sheet. Grains Research and Development Corporation, https://grdc.com.au/Resources/Factsheets/2011/02/Crop-Placement-and-Row-Spacing-Southern-Fact-Sheet

81 Hart (2010) Pulse row spacing and standing stubble. Hart Trials Results 2009. Hart Field Site, http://www.hartfieldsite.org.au/media/TRIALS%20RESULTS%20BOOKS/HART2009TrialsResultsBook.pdf

pre-emergence and in-crop. In the trial, higher faba bean yields with wide rows could partly be explained by much lower annual ryegrass density (50 plants/m^2) than in the conventional 18 cm spacing (140 plants/m^2). Such large differences in ryegrass populations may have been due to differences in soil disturbance. With no weed control, however, the 54 cm row spacing yielded only 0.16 t/ha.[82]

When dealing with row spacings in faba bean and any other crop, it is about the whole farming system. Row spacing per se cannot be looked at in isolation.

2.4 Herbicide residue management

More information about herbicide damage and plant-back periods for pulses is available in Section 7 Weed Control.

Residues of several herbicides can affect crop rotation choices or cause damage to faba bean crops, particularly after low rainfall.

Avoid use of the long-term residual Group B sulfonylurea (SU) herbicides in wheat when re-cropping with faba bean, including sulfosulfuron, chlorsulfuron and triasulfuron.[83]

Avoid also using the following fallow and in-crop residual herbicides in wheat/faba bean rotations:

- Group B sulfonamides;
- Group B imidazolinones;
- triclopyr/picloram (e.g. Grazon® DS)
- clopyralid (e.g. Lontrel®); and
- shorter-residual Group B sulfonylurea, metsulfuron and metsulfuron/thifensulfuron, particularly during summer (after November).

2.4.1 Management of SU residues in faba bean

Follow plant-back periods (minimum re-cropping intervals) as indicated on label (see Section 7 Weed Control for more information).

If Group B herbicide residues already exist, do not use another Group B herbicide in crop to avoid further crop damage.

2.4.2 Management of 'IMI' residues in faba bean

Be wary of using imidazolinone (IMI) products in a low-rainfall area if you intend to grow faba bean the following year.[84] Soil pH and required rainfall may interact for some IMIs.

Reassess the risk of herbicide-residue damage if IMI products have been used and drought conditions have been experienced during the previous wheat, canola or fallow.

Be wary of using IMI products in short-term chemical fallows or for summer weed control in paddocks planned for faba bean. For example, imazapic (e.g. Flame®) requires 200 mm rainfall in the 3 months before sowing faba bean.[85]

82 S Kleeman, G Gill (2008) Wide row cropping for weed management opportunities. GRDC Update Paper 20 June 2008, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2008/06/Widerow-cropping-for-weed-management-opportunities

83 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

84 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

85 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

The South Australian Research and Development Institute (SARDI) and Southern Pulse Agronomy are screening faba bean lines for IMI tolerance (Photo 6). However, herbicide-tolerant faba bean varieties are several years away.[86]

Photo 4: *SARDI and Southern Pulse Agronomy are screening faba bean lines for IMI tolerance. Herbicide-tolerant faba bean varieties are several years away.*

Photo: Felicity Pritchard

2.4.3 Management of triazine residues in faba bean

In southern Australia, avoid high rates of atrazine to avoid triazine carrying over from triazine-tolerant (TT) canola. That is, do not use more than 1.7 L/ha of triazine herbicides for alkaline acid soils (pH >6.5) or 3.3 L/ha for acid soils (pH <6.5) where the active ingredient (a.i.) is 600 g/L. This equates to a limit of 1.1 kg/ha triazine herbicides for alkaline soils or 2.2 kg/ha for acid soils when using 900 g/kg a.i. The herbicide label does not specify if soil pH is measured in $CaCl_2$ or water.

Consider using lower rates if double-cropping faba bean after a summer forage or grain crop of sorghum or maize in irrigated areas. Revise the strategy completely on highly alkaline clay soils if high rates have been used in summer crops followed by dry conditions.

Post-emergent applications of atrazine should not exceed 1.7 L/ha (for 600 g/L a.i.) or 1.1 kg/ha (for 900 g/kg a.i.).

Do not apply triazines to consecutive crops.

Crop damage is most likely caused by herbicide leaching into seed furrows after heavy rainfall in ridged soils and with shallow sowing.

The risk of crop damage increases where there are low levels of subsoil moisture. Crops in this situation are predominantly surface-rooted and vulnerable to damage from herbicide recharge after each rainfall event.[87]

86 E Leonard (2016) Strong interest in herbicide tolerant pulses. GroundCover issue 121 March–April 2016. Grains Research and Development Corporation, https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-121-Mar-Apr-2016/Strong-interest-in-herbicide-tolerant-pulses

87 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

2.4.4 Management of Group I foliar herbicide residues

Do not sow faba bean if residues from pre-sowing application of a group I herbicide are a possibility.

Be aware that for some 2,4-D and dicamba products the minimum re-cropping interval only begins once 15 mm of rain has fallen.

Avoid using Lontrel® or Grazon® DS in the fallow period before sowing faba bean and closely adhere to plant-back periods.[88]

2.4.5 Testing for herbicide carryover

Growers can test soils for herbicide residues via test strips in paddocks, a pot test or by laboratory testing. Testing for herbicide residues is not an exact science as conditions vary considerably across a paddock. Table 6 highlights some of the advantages and disadvantages associated with three methods of testing herbicide residues

Table 6: Advantages and disadvantages associated with three methods of testing herbicide residues.

Test	Method	Advantages	Disadvantages
Field test	Sow a test strip and observe emerging plants after a rain to note any herbicide symptoms	Inexpensive Very rough guide	Need to wait for a rain Possible sowing delay = yield penalty Herbicide may be at depth Time-consuming
Pot test	Take some soil from the affected paddock and grow a susceptible plant in a pot next to a pot without any suspected herbicide carryover, noticing the differences	Inexpensive Very rough guide	Takes time Sampling errors Over-watering may influence results Herbicide may be at depth
Laboratory test	Soil test affected paddock and send to laboratory for analysis of the grams of active ingredient per hectare	Exact value	Expensive Only as good as the representation of the soil test Takes time for analysis and interpretation of results

Source: G Bardell (2007)

88 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

2.5 Seedbed requirements

Unlevelled paddocks and obstacles such as sticks and stones can cause problems with managing and harvesting faba bean (Photo 5).

The soil surface should be levelled as much as possible, as low-set pods on plants may cause harvest difficulties.[89] Cloddy or badly ridged paddocks and sticks and stones can contaminate the harvested grain and downgrade quality. The harvester may also be damaged.[90]

Consider rolling after sowing on stony or extremely cloddy soils to create a flat seedbed, particularly if dry sowing with a tyne seeder.[91]

Photo 5: *Harvest losses can increase where sticks, stones, soil clods and a ridged surface are present close to low-set pods.*

Photo: Wayne Hawthorne, formerly Pulse Australia

Soils with hardpans may require cultivation before sowing to allow healthy root development.[92]

For stubble-retained farming systems, cereal straw should be left standing at about 30 cm height (see Section 2.3 Stubble and summer weed management for more information).

Sowing into retained stubble can cause blockages and result in stubble piles remaining in the paddock. If not broken down during the season, the piles can be picked up by the header front, causing mechanical blockages and potentially contaminating the grain if they contain excess soil.[93]

Several options are available to manage stubble bunching (see Section 2.3 Stubble and summer weed management).

Many dryland faba bean crops require the header front to be set close to ground level. Small variations in paddock topography, including undulating paddocks and gilgai (crab holes), can lead to differences in cutting height across the header, creating significant harvest losses.

Flex fronts, which follow the contour, are an alternative in these situations. It is hard to avoid contaminating harvested grain with dirt in undulating, gilgai paddocks. This can increase grading losses and add to costs. (See Section 12 Harvest for more information.)

89 B Robinson, M Raynes (2013) Growing faba bean, Agnote, AG0083. Victorian Department of Environment and Primary Industries, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

90 Pulse Australia (2014) Northern faba bean best management practices training course – 2014. Pulse Australia.

91 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

92 P Matthews, H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Agriculture, http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/beans/faba-bean

93 Pulse Australia (2014) Northern faba bean best management practices training course – 2014. Pulse Australia.

2.6 Irrigation layout and planning

Faba bean respond well to irrigation in dry areas. Full or supplementary irrigation is practised in Australia where it is economical, when grown in rotation with other winter and summer crops.

2.6.1 Paddocks and irrigation layout

Irrigation layout is one of the most important factors for successful spring irrigation.

Select paddocks for faba bean with good irrigation layout such as beds or hills and relatively good grades for adequate drainage.[94] Faba bean performs best on bed layouts, as waterlogging in spring is a significant issue on contour layouts (Table 7).[95]

A border-check layout can also be successful with grades steeper than 1:800, or with short runs with water on and off in less than 8 hours. The runs need to be short with free-draining soils that can be irrigated quickly and do not remain saturated.[96]

Furrow irrigation is successful in southern Australian irrigation areas. Crops can be established by either pre-watering and sowing, or dry-sowing and then watering-up. A faba bean crop may not need to be watered again until early spring if winter rainfall is adequate.[97]

Table 7: Trends of possible effect of irrigation layout on average irrigated faba bean yield (t/ha) from Faba Check report data, southern NSW.

Year	Beds	Border-check	Contour	Sprinkler
2000	4.57	3.87	3.29	–
2001	4.37	4.04	3.72	3.70
2002	N/A	N/A	N/A	N/A
2003	5.16	3.77	–	N/A
Average	4.70	3.89	3.51	

Note: Faba bean grown on beds consistently out-performed faba bean grown on any other layout. Water use efficiency of faba beans grown on beds is higher than faba beans grown on border check.
Source: Faba Check report data, southern NSW

When growing irrigated faba bean, avoid heavy clay or dense soil types (bulk density more than 1.5) or those that do not drain freely and are subject to waterlogging.

Do not grow faba bean on freshly land-formed paddocks, particularly if there are large cut-and-fill areas.

2.6.2 Sowing irrigated faba bean

Rolling may be required to flatten the ridges left by press-wheel furrows or to flatten clods.

Do not sow too early as irrigated faba bean crops can suffer from lodging.

For irrigated beds, sowing can become extremely difficult once beds with heavy stubble become moist. Firm beds are often easier to sow than soft, fluffy beds[98] (see Section 4 Planting for more information).

94 Pulse Australia (2016) Best management guide .Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

95 R Whitworth (2005) Faba Check in Southern NSW – what have we learned? Faba Bean Symposium: The Performance Pulse, Darlington Point, NSW. Pulse Southern NSW. pp 17–21.

96 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

97 P Matthews, H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Agriculture, http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulses/beans/faba-bean

98 M Kirkman, S Kirkman (2005) Land preparation and seeding issues. Faba Bean Symposium: The Performance Pulse, Darlington Point, NSW. Pulse Southern NSW. pp 45–47.

2.6.3 Irrigated faba bean crop management

Irrigation can be used in activating and incorporating several pre-emergent herbicides.

Faba bean is more sensitive to foliar diseases under irrigation, compared with dryland crops. Waterlogging for a short time during flowering and podding may result in severe losses, particularly if the crop is stressed from factors such as herbicides and disease. Aim to prevent a build-up of disease[99] during winter. Protect faba bean crops in spring before each watering while the canopy humidity and disease risk are high.

Lodging can be an issue at harvest for irrigated faba bean crops. This can be worse on beds, as plants are harder to pick up from furrows. In this case it is important to harvest in one direction.[100]

2.6.4 Irrigation management

Monitor soil moisture for good irrigation scheduling, for higher yields and grain quality while supporting a more sustainable irrigated farm.[101]

Pre-irrigate to fill the moisture profile prior to sowing all faba bean crops, unless this has already been achieved by rainfall.

Water-up on beds, rows and under sprinkler irrigation. This is not recommended for border-check layouts unless moisture is insufficient to achieve a uniform germination.

Generally, start to in-crop irrigate early, when there is a deficit of between 30–40 mm and about 60–70% field capacity. Moisture scheduling is more important than growth stage.

Timely spring irrigations are important. Aim to minimise moisture stress by using optimum irrigation layouts. Irrigate before flowering to prevent moisture stress and high temperatures, which limit yield, quality and grain size. Hot conditions during September and October can affect yield, especially in dry seasons. Crops on beds may require two to three spring irrigations, after being watered up. A survey of 57 faba bean crops in 1991 in southern NSW revealed that half of these crops (29) yielded at least 3.0 t/ha; some above 5.0 t/ha. Nearly two in three of these top-yielding crops were watered three times in the spring.[102]

If furrow irrigating, water every second row to avoid waterlogging. Doubling siphons can increase water flow and reduce irrigation time.

Aim to complete watering in less than eight hours and have good tail-water drainage to avoid any waterlogging. Do not irrigate if crops are at risk of waterlogging and avoid irrigating if there is likelihood of rain soon after.

Faba bean is more sensitive to waterlogging during its reproductive stage (flowering and podding). When grown on beds or rows, this usually does not pose a risk with spring irrigation.[103] However, if crops are grown on border-check layouts and with heavy soil types or long runs, this can be a problem. If in doubt, do not water.

Sprinkler irrigating is ideally suited to growing pulses as there is very little risk of waterlogging, even during flowering and pod-fill. However, there may be a need for greater disease control against chocolate spot, rust or Ascochyta blight due to more frequent wet conditions. In 2014, faba bean crops yielded 4.9 t/ha in southern NSW under sprinkler irrigation.

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99 Pulse Australia (2016) Best management guide .Faba bean production: Southern and Western Region. Pulse Australia, 15 January 2016, http://pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean/southern-guide

100 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

101 R Hoogers (2005) Soil moisture monitoring. Faba Bean Symposium: The Performance Pulse, Darlington Point, NSW, Pulse Southern NSW. pp 37–44

102 R Hoogers (2005) Soil moisture monitoring. Faba Bean Symposium: The Performance Pulse, Darlington Point, NSW, Pulse Southern NSW. pp 37–44.

103 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia

Faba bean is one of the field crops more sensitive to salinity (Table 8). Yield reductions can occur when irrigated with saline water.[104 105]

Table 8: Field crops' water salinity (ECw) tolerance. Faba bean is one of the most sensitive crops to salinity. During the early seedling stage of the most tolerant crops, ECw should not exceed 3.0 dS/m.

Field crop	Nil reduction (dS/m)	10% yield reduction (dS/m)
Barley	5.3	6.7
Canola	4.3	7.3
Wheat	4.0	4.9
Oats	3.3	4.2
Faba bean	1.1	1.8

Source: Salinity tolerance in irrigated crops (2014)

Photo 6: *Irrigated faba bean grown on beds.*

Photo: Trevor Bray, formerly Pulse Australia

104 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

105 J Lacy (2015) Finley irrigated wheat, canola and faba bean systems results 2014. GRDC Update paper 12 March 2015, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Finley-irrigated-wheat-canola-and-faba-bean-systems-results-2014

2.7 Yields and yield targets

2.7.1 Seasonal outlook

Seasonal outlooks may assist growers in making crop choices and managing crops. They may aid in assessing potential yield of crops before sowing and throughout the growing season.

The Break newsletter (Victoria)

Agriculture Victoria provides seasonal climate risk information to grain growers in 'The Break' newsletter. The newsletter describes credible seasonal outlooks, generates potential crop yields from digital decision-support tools, provides links and highlights topical climate risk information. The Break summarises rainfall, crop condition and potential yield for cropping regions across Victoria.

Another newsletter is 'The Fast Break', which details oceanic and atmospheric climate driver activity over the past month and summarises 3-month model predictions for the Pacific and Indian oceans, rainfall and temperature for Victoria.

'The Very Fast Break' is a 2-minute video summarising oceanic and atmospheric climate drivers and the summarised model predictions for rainfall and temperature for Victoria. The Break newsletters and videos are available on the Agriculture Victoria website (http://agriculture.vic.gov.au/agriculture/weather-and-climate/newsletters).

Understanding weather and climate drivers

For tips on understanding weather and climate drivers, including the Southern Oscillation Index (SOI), visit the Climate Kelpie website (http://www.climatekelpie.com.au/) or watch Agriculture Victoria's Climatedogs video (http://agriculture.vic.gov.au/agriculture/farm-management/weather-and-climate/understanding-weather-and-climate/the-climatedogs-the-four-drivers-that-influence-victorias-climate).

CliMate

Australian CliMate (http://www.australianclimate.net.au/) is a suite of climate-analysis tools delivered online, and on iPhone, iPad and iPod Touch devices. CliMate allows you to review climate records relating to rainfall, temperature, radiation, and derived variables such as heat sums, soil water and soil nitrate, as well as El Niño–Southern Oscillation status. It is designed for decision-makers such as growers, whose businesses rely on the weather. It is available for download from the Apple iTunes (https://itunes.apple.com/au/app/australianclimate/id582572607?mt=8).

One of the CliMate tools, 'Season's progress?', uses long-term weather records to assess progress of the current season (rainfall, temperature, heat sums and radiation) compared with the average and with all years. It explores the readily available weather data, compares the current season with the long-term average and graphically presents the spread of experience from previous seasons.

Crop progress and expectations are influenced by rainfall, temperature and radiation since planting. 'Season's progress?' provides an objective assessment based on long-term records.

Bureau of Meteorology

The Bureau of Meteorology (http://www.bom.gov.au/) has recently moved from a statistics-based to a physics-based model for its seasonal climate outlooks. The new system has better overall skill, is more reliable, allows for incremental improvements in skill over time, and provides a framework for new outlook services including multi-week/monthly outlooks and the forecasting of additional climate variables.

MORE INFORMATION

GroundCover™ TV: Managing summer fallow https://www.youtube.com/watch?v=5Kp5woTOo7c

HowWet?

HowWet? (http://www.australianclimate.net.au/About/HowWetN) is a program that uses records from a nearby weather station to estimate how much plant-available water (PAW) has accumulated in the soil and the amount of organic nitrogen that has been converted to an available nitrate during a fallow.

HowWet? tracks soil moisture, evaporation, run-off and drainage on a daily time-step.

2.7.2 Stored soil moisture

Measure stored soil moisture

Deep soil tests can provide soil moisture measurements in the lead-up to sowing. Growers can also measure soil water at sowing and estimate plant-available water.

Soil moisture probes can help people confirm decisions or assist decision-making.

Agriculture Victoria provides live deep soil moisture data from 11 sites to help dryland growers and advisers/managers validate the technology, and delivers training to interpret the data for crop decision-making.[106]

Plant-available water capacity

Plant-available water capacity (PAWC) is a measure of the ability of a soil to store water for crop production.

The two most important parameters are the drained upper limit (DUL) and the crop lower limit (CLL) of the soil.

Knowledge of PAWC, and in particular CLL, is necessary to calculate plant-available soil water at sowing – required for Agricultural Production Systems sIMulator (APSIM) models – from soil test results (see Section 2.7.4 Setting target yields for more information).

Information on 500 different soil types and their PAWC is available from the APSoil database (www.apsim.info) and the Australian Soil Resource Information System (ASRIS) website (www.asris.csiro.au).[107]

Retaining stubbles and controlling summer weeds may help to reduce water loss between winter crops. Control of summer weeds is a major contributor to improved water use efficiency in crops in southern Australia[108] [109] (see Section 7 Weed Control for more information).

The ability to store summer rainfall may also depend on the size of the rainfall events, with the potential benefit of stubble retention being greatest where moderate rainfall is received during the fallow period. Small amounts of rain may evaporate quickly irrespective of the presence of stubble, whereas high rainfall may allow soil moisture to accumulate irrespective of the presence or absence of stubble.[110]

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106 Agriculture Victoria (2016) Soil Moisture Monitoring in Dryland Cropping Areas. Risk management through soil moisture monitoring project. Agriculture Victoria, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/soil-moisture-monitoring-in-dryland-cropping-areas

107 GRDC (2009) Water use efficiency fact sheet. Grains Research and Development Corporation, https://grdc.com.au/Resources/Factsheets/2010/02/Water-Use-Efficiency-SouthWest

108 GRDC (2015) GrowNotes™: Field Pea (northern region). Grains Research and Development Corporation, https://grdc.com.au/Resources/GrowNotes™

109 J Hunt (2013) Control summer weeds to reap yield benefits. GroundCover Supplement Issue 103 March–April 2013. Grains Research and Development Corporation, https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/GCS103/Control-summer-weeds-to-reap-yield-benefits

110 V Sadras, G McDonald (2012) Water use efficiency of grain crops in Australia: principles, benchmarks and management. Grains Research and Development Corporation, www.grdc.com.au/GRDC-Booklet-WUE

FEEDBACK

MORE INFORMATION

GRDC 2009 Water use efficiency Fact Sheet www.grdc.com.au/GRDC-FS-WaterUseEfficiencySouthWest

2.7.3 Water use efficiency

Water use efficiency (WUE) is the measure of a cropping system's capacity to convert water into plant biomass or grain. It includes both the use of water stored in the soil and rainfall during the growing season.

WUE relies on:

- the soil's ability to capture and store water;
- the crop's ability to access water stored in the soil and rainfall during the season;
- the crop's ability to convert water into biomass; and
- the crop's ability to convert biomass into grain (harvest index).[111]

2.7.4 Setting target yields

French-Schultz model

Rainfall is the main driver of potential yield in the dryland cropping environment of Australia.

A simple model to estimate water-limited potential yield was developed by scientists French and Schultz in South Australian for cereals, and is widely used in Australia.

The model is:

potential yield (kg/ha) = (crop water supply (mm) – 110 mm) x 20 kg/ha/mm.[112]

The 110 mm is the estimated soil evaporation and 20 kg/ha/mm is the potential WUE for wheat. Crop water supply (mm) in the medium and low-rainfall zones of the southern region are growing-season rainfall plus stored moisture.

For pulses and canola, the typical parameters used are 15 kg/ha/mm for WUE, and 130 mm for soil evaporation (Figure 3). Of note, for pulses this could now be less than the original 130 mm given modern stubble-retention systems retain more soil moisture.

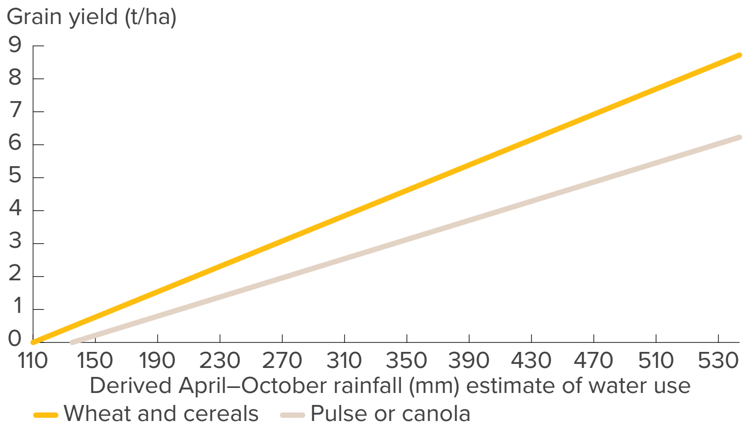

Figure 3: *Relationship of grain yield (t/ha) to estimated water use April–October. Pulses, 15 kg/ha.mm water available over 130 mm; cereals, 20 kg/ha.mm available over 110 mm.*

Source: Grain Legume Handbook (2008), from French and Schultz model

111 GRDC (2009) Water use efficiency fact sheet. Grains Research and Development Corporation, https://grdc.com.au/Resources/Factsheets/2010/02/Water-Use-Efficiency-SouthWest

112 R French, J Schultz (1984) Water use efficiency of wheat in a Mediterranean type environment: I. The relation between yield, water use and climate. Australian Journal of Agricultural Research 35. pp 743–764. W Hawthorne, pers. comm.

In practice, growers typically use a variation of the French–Schultz method, such as:

Potential yield (kg/ha) = (available rainfall* – 110 mm) x WUE*****

where

* available rainfall = GSR + 25% summer rainfall

** or 60 mm evaporation for stubble-retained systems

*** WUE = 8 to 10 kg/ha/mm for faba bean

WUE of faba bean grain in Western Australia has been measured as 10.4 kg/ha/mm, ranging from 7.7–12.5 kg/ha/mm[113]. Soil evaporation was 100–125 mm, similar to cereals.[114]

While the French–Schultz model can be used to determine an upper limit of water-limited potential yield, it often overestimates actual yield as it does not account for rainfall distribution, run-off, drainage or stored soil water.[115]

The different pulses and their systems do differ though in their water-limited yield potential (Figure 4). Faba bean has the highest yield potential of the pulses at high-yielding locations, whereas field pea has the highest yield potential at low-yielding, water-restricted locations.[116]

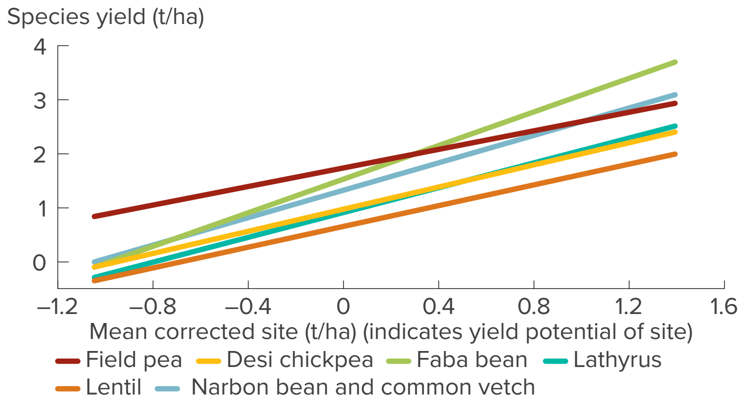

Figure 4: *Variation in grain yield of different grain legume species across sites with different yield potential in Western Australia.*

Source: Kadambot Siddique (2016)

113 V Sadras, G McDonald (2012) Water use efficiency of grain crops in Australia: principles, benchmarks and management. Grains Research and Development Corporation, www.grdc.com.au/GRDC-Booklet-WUE

114 K Siddique, K Regan, D Tennant, B Thompson (2001) Water use and water use efficiency of cool season grain legumes in low rainfall Mediterranean-type environments. European Journal of Agronomy 15 (4). pp 267–280, http://www.sciencedirect.com/science/article/pii/S116103010100106X

115 Y Oliver, M Robertson, P Stone, A Whitbread (2009) Improving estimates of water-limited yield of wheat by accounting for soil type and within-season rainfall. Crop and Pasture Science 60. pp 1137–1146.

116 W Hawthorne, pers. comm.

FEEDBACK

MORE INFORMATION

GRDC 2009 Plant parasitic nematodes Fact Sheet
www.grdc.com.au/GRDC-FS-Plant-Parasitic-Nematodes-SW

APSIM

Sophisticated crop simulation models such as the Agricultural Production Systems sIMulator (APSIM) – and its commercial interfaces Yield Prophet® and WhopperCropper® – can combine detailed data about soil water-holding capacity, soil moisture at sowing, long-term climate data, weather data, potential crop responses to available moisture and additional inputs, in order to estimate potential yield.[117]

APSIM is internationally recognised as a highly advanced simulator of agricultural systems.

For a comprehensive description of the processes simulated by APSIM for faba bean, refer to Turpin *et al* (2003).[118]

For faba bean, the APSIM model was tested over diverse conditions in Australia, using experimental data. APSIM was based on the old variety Fiord, which has a reasonably high thermal time relative to photoperiod response for flowering. It probably would not work as well with varieties that have a greater photoperiod response, such as Nura⁽ᴰ⁾ and PBA Rana⁽ᴰ⁾.

Simulated grain yield explained 87% of the variance in actual yields.

Issues that still need to be accounted for in APSIM include:

- lodging;
- variation in harvest index under wet or cold conditions;
- variation within genetic material in their photoperiod response; and
- accurate simulation of the response of leaf area expansion under mild levels of water deficit.[119]

2.8 Nematode status

Knowing which root-lesion nematode (RLN) species are present is critical for best management because each species can build up on different crops[120] (see Section 9 Diseases for more information).

117 GRDC (2009) Water use efficiency fact sheet. Grains Research and Development Corporation, https://grdc.com.au/Resources/Factsheets/2010/02/Water-Use-Efficiency-SouthWest

118 J Turpin, M Robertson, C Haire, I Rose (2003) Simulating fababean development, growth, and yield in Australia. Crop and Pasture Science 54 (1). pp 39–52, https://www.researchgate.net/publication/263003662_Simulating_fababean_development_growth_and_yield_in_Australia

119 Pulse Australia (2016) General Agronomy. Southern Faba and Broad Bean – Best Management Practices Training Course Module 4. Pulse Australia.

120 GRDC (2009) Plant parasitic nematodes fact sheet (southern and western regions). Grains Research and Development Corporation, www.grdc.com.au/GRDC-FS-Plant-Parasitic-Nematodes-SW

2.9 Post-harvest grazing of faba bean crops

2.9.1 Nutritional value of faba bean

Faba bean stubble and particularly the unharvested grain residue can provide valuable feed for livestock after harvest (Table 9).

Faba bean has high protein levels and palatability. In Australia lupin grain is generally the preferred pulse for sheep and cattle due to its higher protein, higher fibre and lower starch levels, but field pea and faba bean are also useful.

Table 9: Grazing faba bean stubbles after harvest can provide valuable livestock feed during summer (wheat is shown for comparison).

Per kg dry matter	Faba bean grain	Faba bean stubble	Wheat grain
Metabolisable energy (MJ)	12.8	7.4	14.0
Rumen degradable protein (g)	130	20	87
Undegraded dietary protein (g)	65	6	16
Digestible protein percentage (%)	19.5	2.6	10.3
Fibre (g)	100	500	26
Calcium (g)	1.5	-	0.4
Phosphorus (g)	6.3	-	3.6
Sodium (g)	0.6	-	0.3

Source: Grain Legume Handbook

2.9.2 Introducing livestock to faba bean stubble

The stubble left after a faba bean crop is very nutritious livestock fodder. Sheep and beef cattle tend to respond better to pulse stubbles than cereal stubbles due to the high energy value and protein content of the remaining grain and the digestibility of the straw.

Comparisons between pulse crops have shown faba bean and lupin produce the best weight gains in young Merino sheep.

Summer rains may germinate the residual grain and reduce its food value.

One hectare with 0.5 t/ha on the ground should be able to carry 5 weaners or store lambs for about 3 months. Lower-yielding crops with low pod height may potentially incur harvest losses of 0.7–1.0 t/ha, which create a valuable feed source for livestock.[121]

If there are still reasonable quantities of grain remaining on the ground, older sheep can be used to clean up the area.

In trials Dorset-Merino cross lambs ranging from 6–23 kg liveweight (3–8 weeks old) grew well (0.18 kg/day, 1.26 kg/week) on faba bean and lupin stubble containing about 1.0 t/ha of fallen grain.[122]

Grazing lambs on faba bean stubbles has reportedly increased lamb weights by 2.0 kg/week over 5–7 weeks in a grower case study. The successful system involves gradually introducing faba bean grain to lambs prior to grazing the

121 K Penfold (2007) Beans drive up grazed-grain profits. GroundCover Issue 67 March–April 2007, https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-67-March-April-2007/Pulses

122 Grain Legume Handbook Committee (2004) The role of pulses. Grain Legume Handbook. J Lamb, A Poddar (eds.) Grain Legume Handbook Committee.

stubbles and waiting until lambs weigh 40–50 kg before they enter a faba bean stubble paddock.[123]

2.9.3 Calculating grain residues

The grain on the ground should be measured to make the best use of the stubbles.

The amount of grain remaining on the ground can be measured by making a square with 50 cm sides out of fence wire.

The square should be taken out into the paddock and placed on the ground and the grain lying inside the square collected. This should be done at 30 places across the paddock.

Bulk all the grain collected and weigh it. The result (in grams) from the 30 samples should be multiplied by 1.33 to give the number of kilograms per hectare of grain.[124]

2.9.4 Withholding periods and export slaughter intervals

If the faba bean stubble has been treated with pesticides, growers must adhere strictly to withholding periods and, for exported livestock, to the export slaughter interval (ESI). For example, the ESI for faba bean stubble and grain treated with chlorothalonil is a minimum of 9 weeks.[125]

This means that stock grazing stubble of a faba bean crop that was treated with chlorothalonil during the growing season cannot be slaughtered for 9 weeks after their removal from that stubble. This ESI therefore often precludes the use of chlorothalonil for in-crop disease control because graziers aim to finish lambs on faba bean stubble and send them straight to abattoirs.

123 K Penfold (2007) Beans drive up grazed-grain profits. GroundCover Issue 67 March–April 2007, https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-67-March-April-2007/Pulses

124 Grain Legume Handbook Committee (2004) The role of pulses. Grain Legume Handbook. J Lamb, A Poddar (eds.) Grain Legume Handbook Committee

125 C Benjamin (2015) Keep Australia's exports clean. Observe MRL and ESI regulations when feeding pulse grain and stubble. Pulse Industry Updates 22 September 2015. Pulse Australia, http://pulseausblog.tumblr.com/post/129634435305/keep-australias-exports-clean