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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

FABA BEAN

SECTION 1

PLANNING AND PADDOCK PREPARATION

PADDOCK SELECTION | KEY REQUIREMENTS FOR FABA BEANS | BENEFITS OF FABA BEANS AS A ROTATION CROP | DISADVANTAGES OF FABA BEAN AS A ROTATION CROP | FALLOW MANAGEMENT | SOIL MOISTURE | YIELD AND TARGETS | DISEASE STATUS OF PADDOCK | NEMATODE STATUS OF THE PADDOCK | INSECT STATUS OF PADDOCK

Planning/Paddock preparation

Key messages

- Pulse and cereal crops are complementary in a cropping rotation.
- Pulses fix their own nitrogen (N), leaving available nitrogen in the soil for the following crops.
- Faba beans are more efficient at fixing N than most legumes, principally because of their nitrate tolerance.
- Avoid soils that are shallow, acidic or very light and sandy in texture.
- If sowing more than one variety, ensure there is at least 500 metres between them.

1.1 Paddock selection

Uniformity of soil type, paddock topography, and the surface condition of the paddock are preferable for faba bean production. Use a roller after sowing where needed to level the soil surface.

Harvest losses are much higher in rough or uneven paddocks, particularly in dry seasons when crop height is reduced. Sticks or rocks, eroded gullies or gilgais ('melon' or 'crab' holes) will prevent headers from operating at a low cutting height. Uneven paddocks can also increase the risk of contamination in the sample. The smoother the paddock the better the harvesting result, particularly when using headers with wide fronts.

Faba beans are easier to harvest than chickpeas or field peas in these conditions, but can be prone to lodging when planted too early. Frost can cause 'hockey stick', which can also lead to some harvesting difficulties, although newer varieties have better tolerances to this phenomenon.

Management of the fallow after wheat or barley should start when the cereal is harvested, ensuring that stubble from the previous cereal crop is best kept at ~30 cm height to maintain a suitable environment for planting faba beans. [1]

Aim to direct-drill faba beans into standing cereal stubble. Crops reliably yield 10% higher when established this way.

The presence of thick stubbles at sowing can cause stubble bunching and clumping which can affect the evenness of faba bean plant emergence and performance of pre-emergent herbicides.'

Management options for dealing with stubble clumping include:

- Use a no-till (disc) seeder or other seeder capable of handling heavy stubble.
- Modify existing air seeders (altering tine shape and lifting some tines).
- Sow before soil and stubble become too wet.
- Use rotary harrows to spread and level stubble.
- Standing stubble can be slashed or burnt if sowing equipment with good trash flow is not available.
- Planting between standing cereal stubble protects the young faba bean plants from early frosts and helps to prevent the spread of viruses from thrips and aphids [2] (Photo 2).

1 P Matthews and H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/157729/faba-bean-pt1.pdf

2 G Onus. Fababean Growing Program. Landmark Moree.

- Harvest low the previous year's cereal crop to lower stubble and increase stubble flow through seeders. [3]

Crop maturity can be significantly affected by moisture supply during the growing season. Any major changes in soil type and moisture-storage capacity across a paddock can lead to uneven crop maturity, delayed harvest, and increased risk of weather damage and/or high harvest losses due to cracking and splits. Uneven crop development also complicates the timing of insecticide sprays, timing of desiccation, and disease management.

The best soils for faba beans are deep neutral to alkaline, well-structured soils with high clay content. Avoid soils that are shallow, acidic (pH in $CaCl_2$ <5.2), or very light and sandy in texture. Growers considering planting faba beans on lower pH soils need to check for aluminium (Al) and manganese (Mn) levels, because these will adversely affect plant growth. If soil pH is <5.2, an application of lime should be considered. Avoid soils that are acid at depth, i.e. (pH in $CaCl_2$ <5.2) at 20–30 cm. [4]

Soil sodicity should also be checked, and soils with high exchangeable sodium percentages (ESP) should be avoided as crop establishment and development is poor in these soil types. (Photo 1).

Photo 1: *Soils with high exchangeable sodium percentages (ESP) should be avoided.*

Photo: Drew Penberthy, Penagcon

Weed management for all pulses should involve particular attention to controlling broadleaf weeds in the preceding crop to minimise broadleaf weed pressure in the pulse crop due to the lack of broadleaf selective herbicide options. Be aware of any residual herbicide usage. [5]

3 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

4 DEPI (2013) Growing faba bean. Note number AG0083. Rev. edn. Department of Environment and Primary Industries Victoria, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-faba-bean

5 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

Photo 2: *Planting between standing cereal stubble protects the young faba bean plants from early frosts and helps to prevent the spread of viruses from thrips and aphids.*

Photo: Drew Penberthy, Penagcon

FAQ

1.2 Key requirements for faba beans

Faba beans prefer well-drained loam to clay soils with a pH in the range 5.4–8.0.

They can grow in areas prone to waterlogging, and are the pulse most tolerant of waterlogging (Photo 3). However, they must be well nodulated and have foliar diseases controlled to survive prolonged, waterlogged conditions.

Photo 3: *Faba beans prefer well-draining loam to clay soils but are considered the pulse most tolerant to waterlogging.*

Faba beans are moderately susceptible to hostile subsoils, with boron toxicity, sodicity and salinity perhaps causing patchiness in affected paddocks. Faba beans have very low exchangeable Aluminium tolerance.

Tolerance to sodicity in the root-zone (to 90 cm) is: <5% ESP on the surface and <10% ESP in the subsoil (Table 1).

Broadleaf weeds and herbicide-resistant ryegrass can cause major problems in faba beans, and a careful management strategy must be worked out well in advance of sowing. It may be possible to control the weeds in the year prior to cropping. However, it is best to avoid paddocks with specific weeds that cannot be controlled by herbicides. Foliar zinc (Zn), manganese (Mn) and perhaps iron (Fe) may be needed where deficiencies of these micronutrients are known to occur. [6]

If planning to grow faba beans long term, wide rows and hooded sprays should become part of the system.

Agronomist's view

Table 1: *Pulse crop soil requirements.*

Crop	Soil type	Soil pH ($CaCl_2$)	Exchangeable aluminium (%)	Drainage tolerance and rating (1–5)	Sodicity in root-zone (90 cm) (ESP)
Lupins, narrow leaf	Sandy loams	4.2–6.0	20% tolerant	Sensitive (2)	<1 surface <3 subsoil
Lupins, albus	Sandy loams–clay loams	4.6–7.0	Up to 8%	Very sensitive (1)	<1 surface <3 subsoil
Field peas	Sandy loams–clays	4.6–8.0	Up to 5–10%	Tolerant (3)	<5 surface <8 subsoil
Chickpeas	Loams–self mulching clay loams	5.2–8.0	Nil	Very sensitive (1)	<1 surface <5 subsoil
Faba beans	Loams–clay loams	5.4–8.0	Nil	Very tolerant (4)	<5 surface <10 subsoil
Canola	Loams–clay loams	4.8–8.0	0–5%	Tolerant (3)	<3 surface <6 subsoil
Lucerne	Loams–clay loams	5.0–8.0	Nil	Sensitive–tolerant (1–3)	<3 surface <5 subsoil

ESP, Exchangeable sodium percentage. Drainage tolerance: 5, no hardpans and good drainage (no puddles after 24 h from a 50-mm rain event); 1, hardpans—can aggravate waterlogging and cause artificial waterlogging

Source: C. Mullen (2004) NSW DPI Central NSW soils

1.3 Benefits of faba beans as a rotation crop

Pulses and cereals

Pulses and cereal crops are complementary in a cropping rotation. The ways in which a crop affects following crops include well-recognised processes related to disease, weeds, rhizosphere microorganisms, herbicide residues, and residual soil water and mineral nitrogen (N).

6 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

MORE INFORMATION

GRDC (2011) Break crop benefits: western region–why make the break? Fact sheet.

GRDC (2014) Nitrogen fixation of crop legumes: Basic principles and practical management. Factsheet.

Pulses fix their own N, leaving available N in the soil for the following cereal crop. Pulses also play a vital role in controlling major cereal root diseases, particularly take-all.

The combination of higher soil N and reduced root diseases is cumulative and can result in a dramatic increase in subsequent cereal yields. [7]

Disease management

Increased levels of plant-available N are only part of the story. Some of the increases in cereal yield can be attributed to the break effect of the legumes on soil- and stubble-borne diseases.

Crop legumes make generally effective disease breaks, and are usually more effective than a pasture phase because of the potential for grasses to provide alternative hosts for disease. Diseases cause yield loss of cereals, with estimates of losses varying with site, season, species and cultivar.

Quantifying break crop yield increases

Yields of wheat grown after a broadleaf break crop generally exceed yields of wheat grown after wheat or other cereals. The presumed reasons for the yield benefit vary between break crops. They include reduced root and foliar disease, increased supply of soil water and mineral N, reduced assimilate loss to mycorrhizae and, after legumes, growth stimulation following hydrogen gas release.

Angus et al. (2008) quantified the value of break crops by compiling data from published experiments on the additional yield of wheat following oilseeds, pulses or alternative cereals grown in the previous year. Generally, yield increase was not proportional to yield, and the yield contribution of break crops is best expressed in absolute terms, not percentage.

The data suggested control of take-all and residual N after legumes are the largest benefits from break crops (Table 2).

Table 2: *Sources of the break crop effect and estimates of their value at a wheat yield level of 4 t/ha.*

Mechanism for wheat yield increase	Additional wheat yield (t/ha)
Take-all suppression	0.5
Suppression of other root diseases	0.3
Net nitrogen benefit of canola	0.1
Hydrogen fertilisation by legumes	0.4
Suppression of AMF by non-host crops	0.0–0.1
Net nitrogen benefit of legumes	0.5

Hydrogen fertilisation is from increased soil hydrogen after legumes and is assumed at 10%; AMF, arbuscular mycorrhizal fungi

Source: Angus et al. 2008

Legumes such as faba beans, lupins, chickpeas and field peas offer the benefit of hydrogen fertilisation, which stimulates growth by 0–15% due to increased hydrogen in the soil. Estimates of the yield effect of hydrogen fertilisation by legumes are ~10%. [8]

The impacts of a pulse crop on farm profits is a real one with results across 900 experimental comparisons showing that, on average, wheat yields increased by 0.5 t/ha following oats, 0.8 t/ha following canola and 1.0 t/ha following grain legumes (0.7–1.6 t/ha) compared with wheat on wheat. This break-crop effect often extended

7 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

8 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

to a second wheat crop in the sequence, especially following legumes (benefit of 0.2–0.3 t/ha), but rarely to a third except under dry conditions. [9]

The effect of the break crop should be considered over the life of the rotation.

Nitrogen fixation

A pulse crop does not necessarily add large quantities of N to the soil. The amount of nitrogen gas (N_2)fixed is determined by how well the pulse crop grows, reflecting the effectiveness of nodulation, seasonal conditions, crop management, and the level of nitrate in the soil at sowing. Soil nitrate suppresses nodulation and N_2 fixation. Thus, high soil nitrate means low N_2 fixation.

Pulses are usually able to fix sufficient N_2 from the air for their own needs, but a large amount is removed with the grain when crops are harvested.

To understand N budgets for pulse crops, it is important to understand the terminology (Table 3):

Table 3: *Terms used to describe legume N_2 fixation and N-cycling in farming systems.*

Term	Meaning
N fixation	The reduction of atmospheric nitrogen gas to ammonia (NH3). Nitrogen fixation in legumes is a biological process in which root nodule bacteria (rhizobia) fix N_2 via the enzyme nitrogenase.
Total crop N fixed	The total contribution of N_2 fixation to legume biomass, including above-ground vegetation and below-ground roots and nodules. In legumes, 30 to 50 per cent of total crop N is in the below-ground portion of the plant.
Crop N balance	The difference between N inputs and N outputs. N inputs are N_2 fixation and fertiliser N (if applied). Outputs are the N in harvested grain or hay/fodder plus N lost through volatilisation and leaching.
Nitrate-N benefit	The extra nitrate N available after a legume crop; best described as the difference between soil nitrate N when the legume was sown and nitrate N at sowing of the following crop.

Source: GRDC

Soil N levels following a pulse crop usually remain undepleted, so it is the available N that is high.

Where a pulse crop grows well but produces a poor yield, i.e. low harvest index, there may be an increase in total soil N levels. Crops producing average or above average yields are likely to remove as much N as they produce. Generally, then, soil N levels following a pulse crop are the result of a carryover effect of residual N rather than a net gain from the crop (Table 4). In low-yielding cereal–pulse rotations, the pulse may provide enough N for the following crop. [10]

9 J Kirkegaard (2015) Grain legumes can deliver an extra 1 t/ha yield to wheat crops. GRDC, http://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

10 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

Table 4: *Nitrate-N benefit (kg N/ha) from chickpeas and faba beans over a range of grain yields.*

Grain yield (t/ha)	Shoot dry matter (t/ha)	Low soil nitrate at sowing (50 kg N/ha)			Moderate soil nitrate at sowing (100 kg N/ha)		
		N fixed	N balance	Nitrate-N benefit	N fixed	N balance	Nitrate-N benefit
Chickpeas							
1.0	2.4	31	–3	16	13	–21	4
1.5	3.6	74	22	28	47	–5	13
2.0	4.8	120	49	44	84	12	24
2.5	6.0	157	66	48	111	21	38
3.0	7.1	198	88	52	141	31	52
3.5	8.3	231	102	57	164	35	64
4.0	9.6	264	116	61	188	39	69
Faba beans							
1.0	2.8	49	12	15	39	2	3
1.5	4.2	83	25	26	68	10	11
2.0	5.6	120	40	41	100	21	22
2.5	6.9	158	58	45	133	33	36
3.0	8.3	196	75	49	167	45	49
3.5	9.7	234	92	53	202	60	60
4.0	11.1	274	111	57	237	74	64

Source: Grain Legume Handbook, 2008

In a study which quantified nitrogen fixation, Turpin et al (2002) found faba beans fixed more N_2 than chickpeas. Values of N of the total plant including roots were 209–275 kg/ha for faba beans and 146–214 kg/ha for chickpeas. Faba beans fixed between 69-88% N and chickpeas fixed between 64-85% N (Figure 1). Soil N balances, which combined crop N fixed as inputs and grain N as outputs, were positive for the legumes, with ranges 80–135 kg N/ha for chickpeas and 79–157 kg N/ha for faba beans, and negative for wheat (–20 to –66 kg N/ha). [11]

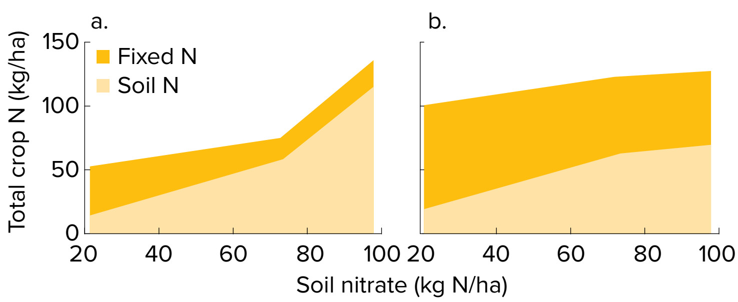

Figure 1: *Effects of soil N supply on soil-N use and N2 fixation of (a) chickpeas and (b) faba beans for days 0–64 of growth. Soil N supply varied with fertiliser N treatment. These data supports the need for early and effective nodulation in faba bean.*

Source: Turpin et al. 2002

11 B Haskins (2012) Using pre-emergent herbicides in conservation farming systems. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/431247/Using-pre-emergent-herbicides-in-conservation-farming-systems.pdf

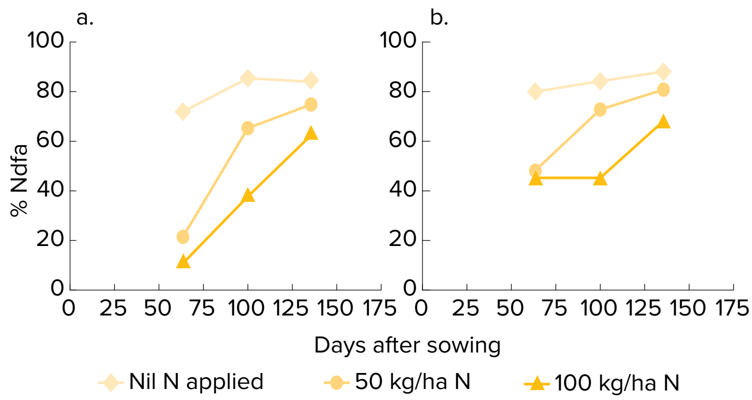

Figure 2: *Effects of available soil nitrogen (applied as N fertiliser) on the percentage of the N that was fixed (i.e. derived from the atmosphere; % Ndfa) over time for (a) chickpea and (b) faba bean. ◆, Nil N applied; ●, 50 kg/ha N; ▲, 100 kg/ha N applied.*

Source: Turpin et al. 2002

MORE INFORMATION

GRDC (2014) Nitrogen fixation of crop legumes: Basic principles and practical management. Fact sheet.

GRDC (2015) Inoculating legumes: A practical guide.

1.4 Disadvantages of faba bean as a rotation crop

A disadvantage of faba beans is that they often struggle to provide an economic return as a 'stand-alone' crop. However, this disadvantage is usually minimised by the benefits they provide to other crops in the rotation. Often, economic benefits realised in the following crops can be attributed to the preceding faba beans and should be compared over a 5-year period not just year by year.

Faba beans have a few other disadvantages. Diseases in wet years are also a concern where the cost of fungicide can out weight the net return. Spraying with a tow-behind spray rig is also an issue later in the season because they grow so tall; a self-propelled spray rig or a plane is usually required after mid-flower. In addition, high water rates for effective prophylactic fungicide application means slow spraying.

There are a limited amount of options for broad leaf weed control in faba beans especially wild radish. This can result in major weed infestations if weed seed banks are high. Volunteers can appear after the crop is harvested.

1.5 Fallow management

Effective weed management in faba beans involves planning at least a season before sowing. Few herbicides are registered for the control of broadleaf weeds, so paddocks must have a low broad leaf weed burden or they must be controlled in the preceding crop and fallow.

Benefits of fallow weed control include:

- Conservation of summer rain and fallow moisture
- Summer fallows conserve valuable nutrients for the crop being sown

Modelling studies show that the highest return on investment in summer weed control is for lighter soils, or where soil water is present that would support continued weed growth. [12]

12 C Borger, V Stewart, A Storrie. Double knockdown or 'double knock'. Department of Agriculture and Food, Western Australia

Use of best management practices such as timely sowing, optimal plant population and adequate nutrition are valuable for weed management, because faba beans compete strongly once canopy closure has occurred. [13]

1.5.1 Fallow chemical plant-back effects

Plant-back periods are the obligatory times between the herbicide spraying date and safe planting date of a subsequent crop.

When planning weed-control programs in crops and fallow prior to faba beans, be cautious about the use of herbicides with damaging residues. Many of the Group B herbicides have long plant-back periods—up to 24 months for faba beans—which are prolonged on dry soils with pH($CaCl_2$) >6.5. [14]

Residues of sulfonylurea herbicides can persist in some soils and can last for several years, especially in more alkaline soils and where there is little summer rainfall. The pulses emerge and grow normally for a few weeks and then start to show signs of stress. Leaves become off-colour, roots may be clubbed, and plants stop growing and eventually die. Unlike other pulses, faba beans are more sensitive to triasulfuron than to chlorsulfuron residues. Faba beans are one of the least-sensitive pulses to chlorsulfuron residues in soil. Refer to the labels for recommendations on plant-back periods for pulses following the use of any herbicides.

Residues of picloram (e.g. Tordon® 75-D) from spot-spraying can stunt any pulse crop grown in that area. This damage is especially marked in faba beans, where plants are twisted and leaves are shrunken (Photos 4 and 5). In severe cases, bare areas are left in the crop where this herbicide has been used, sometimes >5 years ago. Although this damage usually occurs over a small area, correct identification of the problem avoids confusion with some other problem such as disease.

Herbicides such as Broadstrike®, Eclipse®, Flame®, Grazon® DS, Lontrel® and metsulfuron (Ally®, Associate®, Lynx®, Harmony® M) should all be avoided, particularly during the summer fallow or weed-control period (after November).

The use of long-term residual sulfonylurea herbicides such as Monza®, chlorsulfuron, and triasulfuron should be avoided in wheat when re-cropping to faba beans. [15]

13 P Matthews and H Marcellos (2003) Faba bean. Agfact P4.2.7. 2nd edn. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/157729/faba-bean-pt1.pdf

14 B Haskins (2012) Using pre-emergent herbicides in conservation farming systems. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/431247/Using-pre-emergent-herbicides-in-conservation-farming-systems.pdf

15 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

Photo 4: *Previous year's Tordon® spot spray effect. Plants in the affected area are stunted.*

Photo: Grain Legume Handbook, 2008

Photo 5: *Tordon® soil residues affecting faba bean. Note the stem distortion and severe leaf curl.*

Photo: Grain Legume Handbook, 2008

1.6 Soil moisture

Faba bean varieties should be grown only in areas where the rainfall is >350 mm; they are not well suited to lower-rainfall areas. They are very responsive to moisture, and will grow very short with pods close to the ground if moisture is severely limiting. In addition, faba beans do not tolerate hot conditions during flowering; hence, pod set can be poor and flowering terminated prematurely when the weather is hot. Yield potential is therefore severely penalised by adverse hot and dry conditions during flowering.

MORE INFORMATION

Pulse Australia (2015): Residual Herbicides and Weed Control.

Cool conditions are ideal for flowering and podset. Cool and wet conditions are more likely to stimulate foliar diseases if protection is not provided, and foliar disease can adversely affect seedset and yield. Chocolate spot *(Botrytis fabae)* and, in some areas, rust (*Uromyces viciae*-fabae) are now the highest priorities for control in medium- and high-rainfall areas.

Variety choice, crop hygiene, and fungicide choice and timing are all important in a management strategy for foliar diseases of faba beans.

1.7 Yield and targets

Under ideal conditions, pulse crops should be able to produce 12–15 kg/ha of grain for every mm of growing season rainfall over 130 mm. By comparison, wheat can produce 20 kg/ha for every mm of rainfall over 110 mm (Figure 3).

Different pulses have varying yield potentials under different yielding situations, based on yield potential under adequate moisture or drought tolerance (Figure 4).

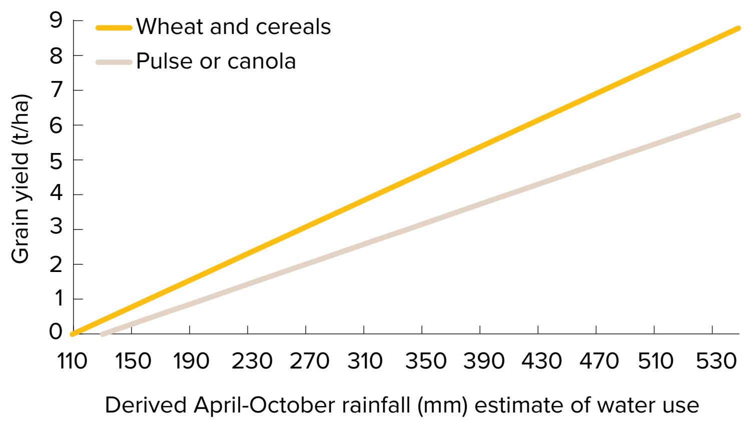

Figure 3: *Relationship of grain yield (t/ha) to estimated water use April–October. Pulses, 15 kg/ha/mm water available over 130 mm; cereals, 20 kg/ha/mm available over 110 mm.*

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

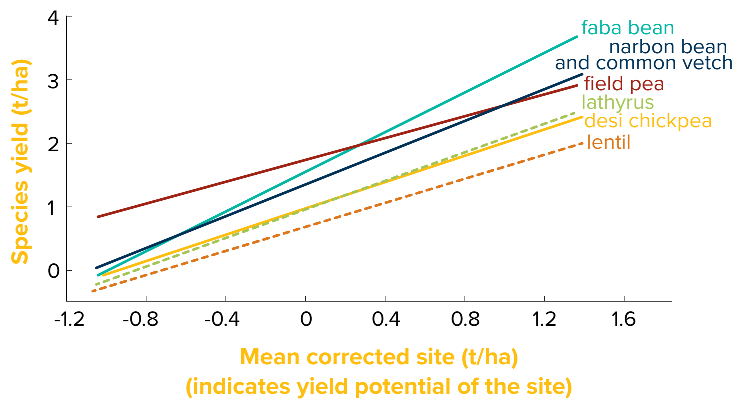

Figure 4: *Variation in grain yield of different grain legume species across sites with different yield potential in Western Australia.*

Source: Adapted from K. Siddique et al. 1999

Ratio of water use to evaporation

The average pulse crop is subjected to an evaporation stress of 600–650 mm from sowing to harvest.

The best yields occur when water use by the crop is 0.7 times the evaporation level, i.e. 420–434 mm.

Temperature

One of the most critical factors affecting pulse yield is temperature. Temperature at flowering can be too high or too low for pollen survival, and hence fertilisation and podset.

Faba beans likely require temperatures ≥10°C (mean daily temperature) at flowering, which is similar to field peas, lentils, lupins and vetch, but lower than the 15°C required by chickpeas. Sunlight, and hence photosynthesis, is critical for podset in faba beans. At temperatures <–1.5°C, the bean plant tissue freezes.

High temperatures (>30°C) can cause flower abortion and cause flowering to cease, even with adequate soil moisture.

For maximum yield, flowering in faba beans and most other winter pulses should be completed by the week in which the average daily maximum temperature reaches 20°C. By comparison, the critical maximum temperature for wheat is 23°C and for chickpeas 30°C.

Cumulative maximum daily temperature (CMDT) can be used to determine the start and end of flowering as well as maturity date. CMDT is calculated by the progressive addition of individual daily maximum temperatures. Table 5 presents CMDTs that different crops need from sowing to reach flowering and harvest.

Table 5: *Cumulative maximum daily temperatures (CMDT) from sowing to various crop growth stages.*

	Beginning of flowering	End of flowering	Harvest
Faba beans	1300	2200	3300
Field peas	1600	2400	3300
Lupins	1600	2400	3600
Chickpeas and lentils			
Early cultivars	1600	2400	3200
Late cultivars	2000	2800	3400
Wheat	1900	2200	3300

Source: Grain Legume Handbook, 2008

The use of CMDT makes it possible to work out the ideal sowing time for pulse crops in a particular area from meteorological information, using the accumulation of maximum daily temperatures with time (i.e. CMDT) and the week that critical flowering temperature occurs.

The sowing time for highest yield in each area can be worked out by defining either:

- when the week of 20°C occurs; or
- when the average daily temperature is first warm enough (>15°C) for the crop to commence flowering and set pods.

Then having defined these dates, count back the CMDT days of cumulative temperature needed for the crop to develop from sowing to that date, using the CMDT units required by faba beans to achieve the start or end of flowering.

1.8 Disease status of paddock

Selection of the most appropriate paddock for growing faba beans requires consideration of several important factors, many of which relate to the modes of survival and transmission of pathogens such as chocolate spot.

Rotation

- Develop a rotation of no more than 1 year of faba beans in 4 years.
- Growers who plan to sow more than one variety of faba beans should ensure at least 500 m between different varieties. Faba beans cross-pollinate, increasing the risk of the breakdown of disease resistance, and of the production of mixed seed types that are difficult to market.
- Plant faba beans into standing stubble of previous cereal stubble to protect against rain-splash of soil-borne spores, protect against erosion, and reduce attractiveness of the crop to aphids (aphids may be vectors for viruses).
- Consider previous crops that may have hosted pathogens such as *Sclerotinia* spp., *Rhizoctonia solani*. and *Phoma medicaginis*.
- *Ascochyta fabae* and *Botrytis fabae* are faba bean-specific, whereas *Botrytis cinerea* has a wide range of hosts, including chickpeas.
- *Phoma medicaginis* var. *pinodella* can be hosted by lucerne, clover, field peas, lupins, chickpeas and *Phaseolus* spp. (various beans).

History of faba bean diseases

- A previous occurrence of soil-borne diseases (Sclerotinia stem rot, stem nematode or perhaps *Pratylenchus* nematodes) constitutes a risk for subsequent faba bean crops for up to 10 years.
- Reduce disease risk by avoiding sowing adjacent to vetch crops or stubble. They may harbour *Botrytis fabae*, the primary cause of chocolate spot in faba beans

- Plant at least 500 m (preferably more) away from the previous year's bean crop.

Weeds

- Almost all weeds host *Sclerotinia* spp.
- Some of the viruses affecting faba beans also have wide host ranges. Weeds, particularly perennial legumes, host viruses (e.g. Cucumber mosaic virus) and their aphid and leafhopper vectors.

Herbicide history

- Determine whether triazine, 'imi' or sulfonylurea herbicides been applied in the last 12 months
- The development of some diseases is favoured in herbicide-weakened plants.
- The presence of herbicide residues in the soil may cause crop damage and thus confusion over in-field disease diagnosis. It also has a major effect on nodulation. [16]

Faba beans are also at risk of getting sclerotinia, Growers should be aware of the sclerotinia risk of selected paddocks where the disease may be transferred between canola and lupins.

Agronomist's view

MORE INFORMATION

[GRDC (2015) Root-lesion nematodes western region: Tips and Tactics.](#)

[K. Owen et al. (2013) Summer crop decisions and root lesion nematodes: GRDC.](#)

[G M Murray and J P Brennan (2012) The current and potential costs from diseases in pulse crops in Australia: GRDC.](#)

[Crown Analytical Services](#)

1.9 Nematode status of the paddock

The root-lesion nematode (RLN) is a microscopic worm-like organism <1 mm in length that feeds in root tissues. These nematodes are found over 5.74 million ha, or approximately 65%, of the cropping area of WA. Populations potentially limit yield in at least 40% of these infested paddocks.

In Western Australia, *P. neglectus* is the main species of RLN, with P. *quasitereoides* (originally described as *P. teres*) the next prevalent and *P. thornei* rarely occurring. It is only *P. quasitereoides* that is known not to occur outside of Western Australia, and worldwide there is little information available for this nematode.

Identification of the nematode species is important to management decisions because varieties and crops species differ in their resistance or susceptibility to different members of the *Pratylenchus* genus. For example, field peas, lupins and faba beans are resistant to *P. neglectus* but susceptible to *P. penetrans*.

The most important management tool is the use of rotations that effectively reduce RLN populations. In heavily infested paddocks, resistant break-crops should be grown for one or two years to decrease the population. [17]

1.10 Insect status of paddock

Soil-dwelling insect pests can seriously reduce plant establishment and populations, and subsequent yield. Soil insects are often difficult to detect as they hide under trash or in the soil. Immature insects such as false wireworm larvae are usually found at the interface between moist and dry soils.

Soil insects include:

- cockroaches
- crickets
- earwigs
- black scarab beetles

16 Pulse Breeding Australia (2013) Southern/Western Faba Bean—Best Management Practices Training Course. Module 1–Rotational Benefits.

17 GRDC (2015) Root-lesion nematodes western region. Tips and Tactics, https://grdc.com.au/TT-RootLesionNematodes

- cutworms
- false wireworms
- true wireworms
- snails and slaters

Different soil insects occur under different cultivation systems and farm management can directly influence the type and number of these pests.

- Weedy fallows and volunteer crops encourage soil insect build-up.
- Insect numbers decline during a clean long fallow due to lack of food.
- Summer cereals followed by volunteer winter crops promote the build-up of earwigs and crickets.
- High stubble levels on the soil surface can promote some soil insects due to the presence of a food source, but this can also mean that pests continue feeding on the stubble instead of germinating crops.
- Zero tillage encourages beneficial predatory insects and earthworms.
- Incorporating stubble promotes black field earwig populations.
- False wireworms are found under all intensities of cultivation but they decline if stubble levels are very low.

Soil insect control measures are normally applied at sowing. Since different insects require different control measures, the species of soil insects must be identified before planting. [18] For more information, see Section 7, Insect control.

18 DAFF QLD (2011) How to recognise and monitor soil insects. Department of Agriculture and Fisheries, Queensland, https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/help-pages/recognising-and-monitoring-soil-insects