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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

FABA BEAN

SECTION 14

ENVIRONMENTAL ISSUES

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Environmental issues

14.1 Temperature

Temperature, daylight, daylength, and drought are the major factors affecting flowering in faba beans. Temperature is generally more important than daylength. Flowering is invariably delayed under low temperatures but more branching occurs.

Progress towards flowering is rapid during long days, while under short daylength, flowering is delayed but never prevented. However, some faba bean varieties are less sensitive to daylength than others. This has enabled breeders to identify improved varieties that flower early in the short-day, winter growing season in southern Australia. [1]

High temperatures

Separating the effects of very high temperature from those of water stress is difficult, because in rainfed agriculture, they nearly always occur together. There is, however, no doubt that high temperature has deleterious effects.

In lupin, short bursts of temperature ≥~35°C can reduce the size of individual seeds and, if this occurs early in seed-filling, will cause seed abortion. Similar effects are likely in other grain legume species. In all pulses, high temperature will cause premature cessation of flowering, and shedding of flowers and young pods. Early maturity of field peas, faba beans and lentils is an effective strategy to escape high temperature. [2]

Temperature and sowing time

Timing of sowing largely determines the timing of the crop's finish and the temperature environment in which it will finish.

Sowings made prior to the recommended sowing window tend to be more vegetative and suffer from:

- poor early podset because of low light or low temperatures (10°C) at flowering commencement
- higher risk of chocolate spot at flowering and through podding
- crops being more pre-disposed to lodging
- increased frost risk at flowering and early podding
- high water use prior to effective flowering and the earlier onset of moisture stress during flowering and podding

Late-planted crops are more likely to suffer from:

- high temperatures and moisture stress during flowering and podding
- greater pressure from native budworms
- fewer branching and flowering sites, unless plant population is increased
- shorter plants and lower podset, which is more difficult to harvest [3]

1 Southern/Western Faba and Broad Bean—Best Management Practices Training Course. Module 3—Varieties, 2013. Pulse Australia.

2 DAWA (2005) Producing pulses in the northern agricultural region. Bulletin 4656, Department of Agriculture Western Australia. http://www.web.uwa.edu.au/__data/assets/pdf_file/0007/920473/Pulse_Manual_Flyer.pdf

3 Southern/Western Faba and Broad Bean—Best Management Practices Training Course. Module 3—Varieties. 2013, Pulse Australia.

MORE INFORMATION

Australian Pulse Bulletin: Minimising frost damage in pulses

14.2 Frost

Faba beans are like many other cool-season pulses in that they are reasonably tolerant of cold conditions, even at flowering. However, sub-zero temperatures in winter can damage leaves and stems of the plant. This occurs particularly in the northern grains region, where severe frosts can cause a characteristic 'hockey-stick' bend in the stem (Figure 1). However, beans have some ability to recover from this damage by being able to regenerate new branches in these severe cases. New regrowth occurs from the base of the frost-affected plants if moisture conditions are favourable.

Some varieties of faba bean released in the northern region have been bred for their tolerance to frosts during the vegetative growth stage. This tolerance in the varieties PBA Warda(ɒ) and Doza(ɒ) means less death of stems and 'club foot', results of severe frost seen in northern Australia, but not in southern areas. Current varieties grown in southern Australia (e.g. Fiesta, Farah(ɒ), Nura(ɒ) and PBA Rana(ɒ)) are susceptible to severe vegetative frosts when grown in northern Australia.

Figure 1: *Severe vegetative frost can cause bends like a hockey stick in faba bean stem and branches in northern Australia. (Photos: G Cumming, Pulse Australia)*

Frosts also cause flower, pod and seed abortion (Figures 2–4). Pods at a later stage of development are generally more resistant to frost than flowers and small pods, but may suffer some mottled darkening of the seed coat.

Frost will normally affect the smallest pods first, even though they are the higher pods on the plant. Similarly, pod abortion induced by moisture stress is normally also noted on the last formed pods in the upper parts of the plant. Visual symptoms of frost and moisture-stress damage to pods are, however, quite different.

Frosts during early flowering affecting early podset can be compensated for later by subsequent pods that set higher up the plant, provided the seasonal conditions are favourable to fill them.

An observation from the paddock shows that the effects of frost on flowers and pods are reduced by having good closure, which stops the frost from getting right down around the stems and pods.

Figure 2: *Frost can cause flower or pod abortion (usually smaller pods). Damage to the seed depends on the size of the pod or seed and the severity of the frost.*

Photo: W. Hawthorne, Pulse Australia

Figure 3: *Frost can cause seed staining from 'burning' the seed coat next to the pod wall.*

Photo: W. Hawthorne, Pulse Australia

Figure 4: *Frosted faba beans.*

Photo: M. Seymour (2005) Producing pulses in the northern agricultural region. DAWA, http://www.web.uwa.edu.au/__data/assets/pdf_file/0007/920473/Pulse_Manual_Flyer.pdf p. 13

14.3 Waterlogging

Too much water, as occurs in waterlogging, results in a shortage of oxygen in the soil. Oxygen is not very soluble in water, and diffuses through it very slowly, so roots in saturated soil soon become oxygen-deficient. Toxic substances produced by changes in soil chemistry may also accumulate in waterlogged soils; these further impair root function. The damage to plants from waterlogging and their tolerance to it depends on the degree and duration of saturation, the soil temperature (oxygen is depleted more quickly in warm than cool soils), the stage of the crop (germinating and seedling crops are generally more susceptible than established crops), and the crop species.

Pulses are generally not well suited to waterlogged soils. Faba beans are the pulse most tolerant to waterlogging and they exhibit some adaptation in new roots when the soil has been saturated for >2 weeks. Faba beans are able to produce good yields under waterlogged conditions that can cause failure of chickpea or lentil crops (Figure 5). The variety Fiesta appears slightly more tolerant of waterlogging than Fiord or Ascot. Importantly, however, the growth of faba beans will still be reduced when they are subjected to extended periods of waterlogging (>2 weeks), and chocolate spot disease is likely to be more severe. [4]

Irrigated faba bean grown at Kerang, Victoria, on drained soils (tile drains at 1.0 m) yielded 4.2 t/ha, whereas undrained crops yielded 2.7 t/ha when sown on raised beds and 1.9 t/ha where sown into a conventionally laser-levelled bay (Drew 1994). The water table level was maintained at about 1.0 m below the soil surface for the season on drained soils, but on undrained soils was 0.1–0.3 m from the surface until September, and then fell away to 0.8–0.9 m to the end of November.

4 DAWA (2005) Producing pulses in the northern agricultural region. Bulletin 4656, 2005, Department of Agriculture Western Australia, http://www.web.uwa.edu.au/__data/assets/pdf_file/0007/920473/Pulse_Manual_Flyer.pdf

Figure 5: *Faba beans (background) and lentils (foreground) grown in a waterlogged area. Waterlogging has killed the lentils, but faba beans appear unaffected.*

Photo: M. Seymour (2005) Producing pulses in the northern agricultural region. DAWA, http://www.web.uwa.edu.au/__data/assets/pdf_file/0007/920473/Pulse_Manual_Flyer.pdf p. 11

Iron deficiency and waterlogging

Iron deficiency may occasionally be observed on alkaline, high-pH soils following a waterlogging event after irrigation or heavy rainfall. The deficiency is due to the interference with iron absorption and translocation to the foliage.

Symptoms include a general yellowing of young leaves, which can develop in severe cases to distortion, necrosis and shedding of terminal leaflets (pinnae).

A mixture of 1 kg/ha of iron sulfate + 2.5 kg/ha of crystalline sulfate of ammonia (not prilled) + 200 mL non-ionic wetter/100 L water has been successfully used to correct a deficiency. [5]

14.4 References

T Adisarwanto, R Knight (1997). Effect of sowing date and plant density on yield and yield components in faba bean. Australian Journal of Agricultural Research 48, 1161–1168.

GK McDonald, T Adisarwanto, R Knight (1994). Effect of time of sowing on flowering in faba bean (*Vicia faba*). Australian Journal of Experimental Agriculture 34(3), 395–400.

DAWA (2005) Producing pulses in the northern agricultural region. Department of Agriculture Western Australia, http://www.web.uwa.edu.au/__data/assets/pdf_file/0007/920473/Pulse_Manual_Flyer.pdf

Southern/Western Faba and Broad Bean—Best Management Practices Training Course 2012. Pulse Australia.

5 Southern/Western Faba and Broad Bean—Best Management Practices Training Course. Module 3—Varieties 2013. Pulse Australia.