In-crop management – environmental impacts

Key points

- Heat waves and moisture stress can adversely affect vetch.
- Vetch seedlings are tolerant of frost but plants are most vulnerable to frost during reproductive phases of flowering, pod-set and grain-fill.
- Vetch is most sensitive to waterlogging at flowering. Avoid growing vetch on poorly drained soils and areas prone to waterlogging.
- Other factors that can impact the growing crop are lack of sunlight and soil erosion.

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10.1 Moisture stress

Vetch is considered a moderately drought-tolerant crop. Vetch is sensitive to waterlogging.

10.1.1 Drought

Moisture stress in vetch influences biomass production and plant height. Hence, it can affect forage and grain yield as well as harvestability when the crop height is too short (to harvest or bale).

Vetch varieties can respond differently to moisture stress depending on their general tolerance (to moisture stress), specifically at flowering.

Timing of moisture stress relative to growth stage is important:

- Seeding/germination: lack of rain can lead to poor establishment and growth.
- Vegetative growth can also be affected by intermittent moisture stress and result in short crops.
- Flower-set can be reduced by drought and warm conditions in spring.
- Pod-set can be aborted, this is usually noted on the last-formed pods in the upper parts of the plant.
- Grain-fill can be reduced, with fewer and smaller grains.

Management to minimise moisture stress

- Control summer weeds.
- Remediate soil compaction and avoid sowing where subsoil constraints (e.g. salt, boron) will impede root growth.
- In low and medium-rainfall areas consider wider row spacing and sow into retained stubble to minimise moisture loss from soil before canopy closure.
- Sow early in early-maturing areas.
- Sow early-maturing varieties.
- Consider cutting grain crops for silage or hay.

10.1.2 Waterlogging

Vetch plants can appear to survive waterlogging and then die as the soil dries. Vetches are susceptible to waterlogging, especially at germination. Common vetch is more susceptible than the other vetch species.

Waterlogging 6 days after germination of vetch can delay the emergence by up to 5 days and reduce the final plant density by 80%. Waterlogging depresses vegetative growth of plants but affects root growth more than shoot growth.

Plants can show symptoms of iron or nitrogen deficiency. They may also show signs of salinity, with the oldest leaf tips dying back from the tip.

Roots are shallow and blackened with root rots. Nodulation can be reduced by extended waterlogging

Vetch, like pulse crops, is most sensitive to waterlogging at flowering. The response of vetch to waterlogging is similar to its response to low light and low temperatures; all result in flower and pod abortion and leaf senescence (drying off).[1]

Management of waterlogging

- Avoid poorly drained soils and areas prone to waterlogging.
- Sow early to improve emergence and adequate growth before water lays, except in high-rainfall areas where sowing shod be delayed.
- Consider using raised beds for vetch grown for grain.

1 Pulse Australia (2016) Southern Lentil: Best Management Practices Training Course. Pulse Australia

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- Monitor regularly for pests and disease as plants are more susceptible to root and foliar disease, and may be more affected by aphids when subjected to waterlogging.

10.2 Temperature

Vetch is like cool-season pulses in its susceptibility to extremes of hot or cold conditions, especially at flowering. Heat waves (temperatures >35°C) and water deficiency (moisture stress) can severely affect vetch.

Plants are most vulnerable to frost during reproductive phases of flowering, pod-set and grain-fill.

10.2.1 Heat

Canopy development in vetch is quite rapid, especially during early sown and warmer winter conditions. At any location, seasonal variations in temperature can bring about a significant shift in flowering times for the same time of sowing (i.e. up to 10 days is possible).

On hot days, the leaves of the vetch plant fold and the stomata close in order to reduce evapotranspiration. Plants can look wilted and appear more blue-grey in colour. A common mechanism to cope with high temperatures is to increase pod and leaf drop.

When heat stress occurs during flowering and pod-filling, significant reductions can occur in grain and forage yield, seed quality and subsequent profitability to the grower.

Management to minimise heat stress

- Apply management to minimise moisture stress and root growth.
- Sow early in early-maturing areas.
- Sow early-maturing varieties.
- Consider cutting grain crops for silage or hay.

10.3 Frost

Grain yield losses from frost damage can be severe for a sensitive crop like vetch.

Frost damage during flowering and pod-fill occurs when the plant is at a vulnerable stage of growth at the time of the frost. Timing is critical,[2] and the level of damage depends on severity and duration of the frost, crop sensitivity, variety maturity and sowing time. Any subsequent frosts can lead to further damage.

Compared to pulses like faba bean, vetch plants flower later and can escape some early frosts.

Frost in pre-flowering stages does not leave vetch more vulnerable to the foliar disease bacterial blight.

During flowering or podding frost can cause significant yield and grain loss due to flower drop and aborted pods. It will normally affect the flowers and smallest pods first; despite the fact they are the higher pods on the plant. Pods at a later stage of development are generally more resistant to frost than flowers and small pods. However, pods may suffer some mottled darkening of the seed coat.

Milder frosts can blacken developing seeds but not all seeds in a pod may be affected. Frosted pods are puffy and the outer layer of skin lifts producing a mottled appearance.

2 F Stoddard, C Balko, W Erskine, H Khan, W Link, A Sarker (2006) Screening techniques and sources of resistance to abiotic stresses in cool-season food legumes. Euphytica 147:167–186, http://www.google.com.au/

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Severe frosts can also deform stems and cause lodging but vetch has some inherent ability to recover from frost damage by being able to regenerate new branches in severe cases. New regrowth occurs from the base of the frost-affected plants if moisture conditions are favorable.

In severe frosts, leaves are killed and the stem is wilted. If the plant is in the vegetative growth sage between node 1 to 5, there can be quick recovery from underground axillary buds. If the plants are at the 7th node stage or beyond, plants will most likely die because axillary bud initiation will most likely not occur as the plant is moving into reproductive stages.

Importantly, unlike chickpea, low temperatures (<2°C) are not known to cause pollen sterility in vetch.

Frost tolerance for vetch at flowering is the same as for lentil, i.e. –2°C to –3°C.

10.3.1 Managing frost

Frost frequency and intensity is unpredictable. Management of frost risk can only be based on the likelihood of a frost occurring, without knowing exactly when, or if, it will happen.

Vetch is a bulky and usually a lodged crop during flowering and pod-fill. This lodged, dense canopy can provide some limited protection to frost, compared with a more upright crop, when frosts do occur.

Sowing too late (to avoid frost during flowering) can lead to shorter crops, poor grain yield, harvest difficulties and poor quality if the season finishes quickly. There is a trade-off between sowing early to maximise forage and grain yield potential, and exposing the crop to a greater risk of frost at flowering.

Although it is difficult to totally minimise frost risk it is important to:

- know the period of highest probability of frost incidence;
- map the topography to show areas of greatest risk and specifically manage these areas to minimise frost damage;
- aim to reduce exposure to frost or impact at vulnerable growth stages;
- choose the appropriate variety and time of sowing;
- choose sowing dates and variety maturity to reduce frost risk;
- wider rows may increase frost risk;
- if frost occurs at flowering consider cutting grain crops for silage or hay.
- manage the pulse canopy: row spacing, retained cereal stubble and small changes in temperature around the critical trigger point can assist in avoiding frost damage;
- consider planting in rows up and down a slope to increase air-flow and cool air drainage;
- understand the impact of soil type, condition and moisture status; and
- manage crop nutrition and minimise crop stress level to lessen frost damage.[3]

10.4 Hail and physical damage

Vetch is sensitive to hail damage. Stems, leaves and pods are damaged in hail. Recovery is dependent on further growth and freedom from foliar disease.

During the vegetative stage hail can shred leaves, bruise stems and slow crop development. Stem breakage and bruising is often on one side. Later hail can remove flowers and pods or flatten crops. Hail can cause a swathe of damage through the crop.

3 W Hawthorne (2007) Managing Pulses to Minimise Frost Damage. Australian Pulse Bulletin PA 2007 #01, http://www.pulseaus.com.au/storage/app/media/crops/2007_APB-Pulses-frost.pdf

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MORE INFORMATION

A video on extreme temperature analysis to better understand frost events. https://www.youtube.com/watch?v=Zw637FiX5PU

GroundCover™ TV: Frost R&D. https://www.youtube.com/watch?v=og9wPzjchjA P511

Frost's emotional impact: is it greater than its economic impact? https://www.youtube.com/watch?v=GC2P2Tha5Es P511

Physical damage from excessive traffic, wind erosion, frost, hail, post-emergent rolling or herbicide damage can increase the spread of foliar disease in vetch, just as it does in pulses.

Offset risk in prone areas by sowing a range of varieties with different maturities. Consider cutting grain crops for silage or hay if severely damaged by hail.

10.5 Chemical leaf spotting

Some spray oils used with post-emergent selective grass herbicides can cause minor leaf spotting and/or burning, which should not be confused with disease symptoms.

Advice from an experienced agronomist should always be sought for specific details on soil and foliar-active chemcals and the risk of crop damage in any particular situation.

10.6 Lack of sunlight

Lack of sunlight can be a major factor in determining the level of pod-set in some pulses in southern Australia. A Mediterranean climate with winter rainfall dominance and a dense canopy can lead to poor pod-set through lack of sunlight. Total radiation, rainfall, evaporation, temperature, humidity and wind strength are all contributing factors to the level of pod-set.

In vetch, as faba bean, the amount of radiation hitting the flower from when it opens and for the following 3 days is the overwhelming contributing factor to level of pod-set.[4]

4 F Stoddard (1993) Limits to retention of fertilized flowers in faba beans (Vicia faba L.). Journal of Agronomy and Crop Science 171 (4): 251-259, http://onlinelibrary.wiley.com/doi/10.1111/j.1439-037X.1993.tb00137.x/abstract