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## **MANAGEMENT OF FUNGAL DISEASES OF LENTIL CROPS**

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### **Introduction**

India is the world's largest producer and the largest consumer of pulses. Pakistan, Canada, Burma, Australia and the United States, in that order, are significant exporters and are India's most significant suppliers. The global pulse market is estimated at 60 million tonnes. Legumes are a significant source of protein, dietary fiber, carbohydrates and dietary minerals. Among pulses lentil is widely used. It is high value cool season pulse crop and serves as a second major source of dietary proteins (25%) after soybeans in human and animal diet. Lentil is the second highly grown winter season legume crop next to chickpea in terms of quality and quantity, Bult *et al.*, 2019.

### **Various fungal diseases of lentil crop:**

**Following are the major fungal and viral diseases of lentil.**

Fungal diseases of lentil are the most important biological constraint to productivity. *Ascochyta lentis* (ascochyta blight) and *Fusarium oxysporum* f. sp. *lentis* (fusarium wilt) are the major fungal pathogens that can cause severe losses in most lentil growing regions of the world. Fungal diseases such as botrytis grey mould (*Botrytis fabae* and *B. cinerea*), rust (*Uromyces viciae-fabae*), stemphylium blight (*Stemphylium botryosum*), and anthracnose (*Colletotrichum truncatum*) are also important in some growing seasons in particular countries when environmental conditions are conducive for infection. Integrated disease management practices including use of resistant cultivars, modified cultural practices and use of fungicides or insecticides can reduce the impact of these diseases on lentil production, Taylor *et al.*, 2007.

### **On-farm hygiene (post harvest-pre sowing)**

Seed retained on-farm should be from the 'cleanest' paddocks, where no disease was detected. The fungal pathogens can carry over from one season to the next on infected lentil seed, stubble and volunteer plants. Fungal pathogen can also carry over on the stubble of alternate hosts such as faba bean, vetch, chickpea or lathyrus that can attack lentils. Reduce stubble from potential pulse crop hosts where feasible i.e. bury, destroy or burn infected crop residue. Burying stubble can significantly decrease the decomposition time of stubble. Grazing helps reduce stubble, however, infected stubble can be carried between paddocks by stock. Be aware of grazing restrictions on stubble treated with fungicides. Infected stubble may also be carried by wind, water or machinery at harvest. Clean all machinery, transport equipment and storage facilities with compressed air before moving to the next paddock. Control volunteer lentils, faba beans, vetch, lathyrus and chickpeas early to limit the build-up of disease inoculum.

## 1. Paddock selection

A break of at least 3 years should be observed between lentil crops. Do not sow adjacent to lentil stubble, particularly downwind. If possible, aim to separate this year's lentil crop from last year's lentil stubble by a distance of at least 250 m. Reduce disease risk by not sowing adjacent or into faba bean, chickpea, vetch or lathyrus stubble. If this is not possible, manage the lentil crop with a high botrytis risk management strategy.

Be aware that early sown faba bean, vetch or lathyrus crops may be a source of botrytis inoculum into adjacent, later sown, lentil crops. If this is not possible to avoid, manage the lentil crop with a high botrytis risk management strategy. Where there is a high risk of sclerotinia, avoid planting lentils after canola or other broadleaf crops which act as alternative hosts to this disease. Avoid paddocks with high soil nitrogen, as this can lead to greater vegetative growth in lentils, predisposing the crop to disease development. Ensure the maximum plant-back period for all herbicides is adhered to, as herbicide residues may weaken the plant's resistance to disease, Bhalla *et al.*, 1992.

## 2. Varieties

Under high disease pressure, all varieties will require fungicide protection to control disease epidemics. Include a variety that best withstands the main disease risk(s) for your region e.g. PBA Herald-XT, PBA Blitz, PBA Jumbo or Nipper for ascochyta blight resistance; PBA Blitz, PBA herald-XT, Nipper or Boomer for some BGM resistance. If growing susceptible varieties, spread risks by sowing more than one variety, each with different resistance characteristics. i.e. don't sow both PBA Flash and Aldinga or both PBA Flash and Northfield if in a BGM prone region. There are many resistant varieties for fusarium wilt disease of lentil.

## 3. Seed

Seed retained on-farm for sowing should be from the 'cleanest' paddocks or section of paddock. Preferably use seed with nil disease infection. A fungal threshold of less than 1% is acceptable. Definitely avoid using seed with greater than 5% infection. Avoid using seed infected with either cucumber mosaic virus (CMV) or alfalfa mosaic virus (AMV). A threshold of <0.1% seed infection is recommended for sowing in high risk areas, and <0.5% seed infection for sowing in low risk areas.

Seed disease testing services are available from SARDI Diagnostic Services, SA, Ph 08 8303 9360, Agrifood Technology, Vic, Ph 03 9742 0555 or AgWest Laboratories ph 08 9368 3721. If seed is more than one year old, frosted, weather damaged or diseased, its germination and vigour may have deteriorated. This may increase its susceptibility to disease attack.

## 4. Seed dressing

Seed should be properly treated with a fungicide to control fungal diseases. Sowing untreated seed infected by pathogen can result in the development of diseases, which can result in early seedling death and reduce seedling establishment. Registered seed treatments to use for lentils are: thiram plus thiabendazole (P-Pickle T®); or thiram alone (Thiraflo® or Thiragranz®). Seed dressings may have a deleterious effect upon rhizobia so their contact time must be minimised. Read the label rhizobia label for compatibilities. Apply seed dressing first and then mix inoculum with seed immediately before sowing. Alternatively

granular or liquid inoculants are now available and will prevent inoculum coming in contact with fungicide on seed.

## **5. Canopy management.**

### **5.1 Sowing rate**

Aim for a plant population of 100-120 plants per square metre. Calculate actual seeding rates (kg/ha) based on seed size because seed sizes vary widely with variety and season. Approximations are 50kg/ha for Nugget or Digger, 60 kg/ha for Aldinga, 40 kg/ha for Nipper or Northfield and 70kg/ha for Boomer. Higher seeding rates can increase the risk of fungal pathogen due to dense canopy growth. Sow to minimise overlap, or avoid sowing headlands, as the higher seeding rate can favour the development of a fungal pathogen epidemic. Seeding rates below the minimum recommended plant populations can reduce yield.

### **5.2 Row spacing**

Wider row spacing can be part of disease management in lentil by keeping the canopy open and drier for longer, provided lodging does not occur. Precision sowing lentils between standing cereal stubble rows allows trellising and keeps the lentils more erect. Without stubble trellising, row spacing's beyond 23 cm makes the lentil crop susceptible to lodging and increase the risk of disease development.

### **5.3. Sowing date**

Lentils are quick to emerge, but their early growth is slow, and they can take a long time to completely cover the ground, especially if maximum daily temperatures are below 15°C. Early sowing results in more vegetative growth and crops prone to lodging, increasing the risk of disease infection and subsequent poor grain quality. Frost risk needs also to be considered. Later sowings reduce disease risk but can result in lower yields due to the risk of dry conditions, high temperatures at flowering-pod fill and reduced crop height making harvest difficult. Disease resistant varieties may be sown earlier than other varieties since disease risk is reduced. Sowing lentils early with wider rows into standing cereal stubble in the belief that it lessens disease risk through delayed canopy closure and less lodging is not proven. The optimum sowing time for lentils is therefore dependent on location, sowing system used and disease risk: Early sowing is usually beneficial in medium to low rainfall areas or in areas prone to early, quick finishes to the season. Spring sowing is desirable in some higher rainfall areas, or areas with a long, late growing season. In a fungal pathogen prone area, sow at the later end of the recommended window for our district and sow varieties like Nipper, Digger or Nugget before varieties like Northfield or Aldinga.

## **6. Fungicide spraying program**

There are three critical periods for fungicide spraying decisions on lentil crops for disease. **First critical period** is at 10-14 weeks after emergence (WAE), shortly prior to canopy closure. Early application of fungicide is critical in restricting the early development. In susceptible varieties, or in districts prone to fungal pathogen epidemics, apply a fungicide.

An application at this stage is the final chance for spray penetration deep into the crop canopy to protect stems. The presence of fungal pathogen at this stage is unlikely to cause significant yield losses in varieties that have moderate resistance to foliar infection. Varieties like PBA Flash and Tiara that are more susceptible may require protection at this early stage.

**Second critical period** is at mid flowering/early pod fill (14-16 WAE). If weather is conducive to disease, apply a fungicide. The type of fungicide used will be dependent on the variety. Mixtures of foliar fungicides may be required to give control for both diseases in some susceptible lentil varieties. Continued infection at this stage will impact on yield by causing stem infection under the canopy and subsequent plant death. Infection of pods by at this stage will impact on seed quality and yield if seed is aborted.

**Third critical period** is at the end of flowering/mid pod fill (16-18 WAE). This is the final growth stage where all pods are formed and protection against fungal infection ensures good seed quality is achieved.

If pathogen present during pod formation and filling, seed staining can occur in many older varieties. PBA Herald-XT, PBA Jumbo and Northfield can be the exception because their seed has resistance to infection and subsequent staining. However in a wet spring even these may require a spray during podding to prevent seed staining. Severe disease can result in yield loss in some varieties due to seed abortion, except PBA Blitz, PBA Herald-XT, PBA Jumbo, Nipper and Northfield. Control may be required though if that disease is severe and weather is conducive to spread.

**Requirements, all periods:** During the critical periods, monitor crops at least once every week and react by spraying ahead of rain events. Fungicide sprays for are likely to be required depending on variety, rainfall and canopy. Fungicide application during the critical periods is a standard practice in high disease risk situations eg. high rainfall regions, in a wet year or in known disease risk zones. A crop is considered to be at high risk if susceptible varieties are grown, crop rotation is tight, planting is adjacent to lentil stubble, where all preventative management strategies cannot be followed, or any combination of factors put the crop at risk. Additional fungicide applications may be required, particularly if conditions are conducive to disease. Take note of grain and grazing withholding periods (WHPs). For crops that are desiccated or windrowed, the WHP is to that date, not actual harvest date.

## 8. Lentil fungicides

Chlorothalonil is considered a better option than mancozeb. Registration regulations limit carbendazim and procymidone to a maximum of two consecutive sprays each. Both are systemic fungicides with single site specificity so the probability of resistance increases with regular use. Alternate the carbendazim or procymidone with a fungicide from a different fungicide group.

## 9. Fungicide spraying

Control is based on preventing new infections, not curing old infections. Stems and lower leaves are not effectively covered by a fungicide applied after canopy closure. Spraying before the canopy closes achieves better fungicide penetration and is more effective than trying to halt an epidemic after the canopy closes or the crop has lodged. Any new growth after spraying is not protected. Spraying ahead of rain prevents fungal infection occurring, rather than waiting until after rain when the disease has already started to spread. Spray early

in the morning as dew will assist in spread of fungicide product over the plant surface. Spraying in light rain is preferable to waiting till after the end of a rain event. Depending on the time of year and growth rate of the crop, the period of fungicide protection can vary. In the cooler winter months the period of protection can be for 2-3 weeks when crops growth rates are generally slower. But in warmer spring conditions this period may be reduced to 7-14 days during rapid crop growth and the emergence of unprotected plant growth. Use high water rates (preferably 100 L/ha by ground or 30 L/ha by air). Flat fan nozzles with a fine/extrafine droplet spectrum & an operating pressure of 400 kPa is best. Surfactants (spreaders) improve initial spray deposits and redistribution (refer to fungicide label). Stickers reduce droplet spread over the leaf surface and are not recommended.

### **10 Early harvest**

Harvest as early as possible to minimise fungal infection. Disease is usually more severe when crops are harvested late. Harvest losses and downgrading in quality can be substantial if lentil harvest is delayed until moisture content is below 12%. Marketing problems are created if receival standards of 1% poor colour (due to disease, water staining, frost) are exceeded.

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