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Chickpea: Botrytis Grey Mould Management

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Background

Botrytis grey mould (BGM) in chickpea is caused by the fungus *Botrytis cinerea*. *B. cinerea* is a significant pathogen of pulse crops particularly lentils, ornamental plants grown under glasshouse conditions, and fruit including grapes, strawberries and apples. Flowers are especially vulnerable to BGM infection. *B. cinerea* does not infect cereals or grasses.

In the northern GRDC region, *B. cinerea* has been recorded on over 138 genera of plants in 70 families. Legumes and asteraceous plants comprise approximately 20% of these records. As well as being a serious pathogen, *B. cinerea* can infect and invade dying and dead plant tissue. This wide host range and saprophytic capacity means inoculum of *B, cinerea* is rarely limiting. If conditions favour infection and disease development, BGM will occur.

This makes management of BGM different from chickpea ascochyta, which is more dependent on inoculum, at least in the early phases of an epidemic.

B. cinerea also causes pre and post-emergent seedling death. This happens when chickpea seed, infected during a BGM outbreak, is used for sowing. This seedling disease does not need the wet conditions that favour BGM.

Symptoms

The first symptom of BGM infection in a crop is often drooping of the terminal branches. If groups of plants are infected, these may appear as yellow patches in the crop (Figure 1).

Figure 1: Photo: Phil Davis

The diagnostic feature is a grey "fuzz" (Figure 2) which, under high humidity, develops on flowers (Figure 3), pods (Figure 4), stems and on dead leaves and petioles.

Figures 2 & 3: Photos: Phil Davis

Lesions can develop anywhere along the stem but are usually first found on the lower part of the stems often starting in leaf axils. Infected seeds are usually smaller than normal and are often covered with white to grey fungal growth (Figure 5).

Figures 4 & 5: Photos: Gordon Cumming

When a severely BGM-infected canopy is opened, clouds of spores are evident (avoid inhaling these). During dry weather the "fuzz" is not obvious, but it develops again when wet weather returns. Small, dark brown/black resting bodies (sclerotes) of *B. cinerea* may develop on infected dead tissue, and are capable of producing spores on their surface.

The stem lesions caused by BGM can be confused with those caused by *Sclerotinia sclerotiorum* (at and above ground level) and by *Sclerotinia minor* (at ground level), but neither of these pathogens produce the grey "fuzz" typical of BGM. Also, sclerotinia lesions tend to remain white, and are covered by a dense cottony fungal growth, in which irregular shaped black sclerotes develop.

In contrast, the sclerotes of *B. cinerea* are more rounded and usually develop after the stems die. They are smaller than the sclerotes of *S. sclerotiorum*, but larger than the angular sclerotes of *S. minor*.

Biology and epidemiology

B. cinerea produces diffuse white fungal growth which later turns grey due to the production of huge numbers of spores borne in clusters at the ends of dark stalks (Figure 6).

Over 10 million spores can be produced on a single 2 cm long lesion on a chickpea stem. Consequently, *B. cinerea* has the capacity to rapidly develop during conducive weather conditions. The spores can be blown many kilometres, and if deposited on chickpea plants they can remain dormant until conditions favour spore germination.

Free moisture is necessary for germination and infection. Lesions and the grey "fuzz" are evident 5-7 days after infection under ideal conditions.

Figure 6: The grey "fuzz" referred to above. Often starts in the leaf axils. Photo: Gordon Cumming

B. cinerea is favoured by moderate temperatures (20-25°C) and frequent rainfall events. It does not become a risk until the average daily temperature (ADT) is 15°C or higher. The combination of early canopy closure, prolonged plant wetness and overcast weather results in high relative humidity and rapid leaf death in the canopy, conditions which are ideal for *B. cinere*a.

B. cinerea can survive on and in infected seeds, in infected stubble, on alternative hosts, in dead plant tissue and as sclerotes. The relative importance of these in Australia is unknown, but recent research in Victoria demonstrated that *B. cinerea* can survive for up to 18 months on infected stubble under field conditions. Other research from Western Australia suggests that sclerotes of *B. cinerea* cannot survive over summer because they lose their viability during hot weather.

Irrespective of its mode(s) of survival, the experience of the 2010 chickpea crop indicates that under conducive conditions, *B. cinerea* can develop rapidly not only within crops, but across districts and regions.

Factors that contributed to the 2010 Botrytis grey mould (BGM) epidemic

The first reports of BGM in the northern GRDC region were in mid September (after ADT reached 15°C), and by mid October most crops were affected to varying extents. This was despite the fact that many crops had received multiple sprays of mancozeb and/or chlorothalonil for ascochyta (both fungicides are effective against *Botrytis* on chickpea and/or other pulse crops).

- **Early sowing (mid April to early May) and narrow rows:**
  This combination plus seasonal conditions caused high biomass crops and early canopy closure Resulting in high in-crop humidity and poor penetration of fungicides.

  Many crops lodged, exacerbating the situation.

- **Frequent overcast, showery weather:**
  Rainfall totals between June and October were well above the long term averages across the northern region. In many cases the number of rainy days during this period was double the long term average. Combined with the early closed canopy in many crops, the microclimate within the crop was ideal for the development of BGM.

  Wet paddocks also limited the spray opportunities for ground rigs.

- **Lack of supply of effective fungicides:**
  The large area of chickpeas sown in the northern region, combined with the sequence of rainfall events early in the season, resulted in a widespread and significant ascochyta epidemic. This resulted in a severe shortage of registered fungicides when BGM started to develop.

  Even after Emergency Use Permits were issued, supplies of BGM fungicides were limited.

- **Lack of BGM tolerant/resistant varieties:**
  There is no useful resistance in Australian chickpea varieties to BGM.

Consequences for the 2011 season

- **Supply of disease free seed:**
  Because most chickpea crops in the northern region were affected by BGM, the supply of BGM free seed from the 2010 harvest will be extremely limited.

- **Carry-over of infected crop residues:**
  Chickpea crop residue (particularly stem and pod tissue) infected with *B. cinerea* is likely to be a significant source of infection for the 2011 crop.

Whether BGM is a problem will depend on seasonal conditions.

Management options

- **Stubble management:**
  It is likely that the pathogen can remain viable and capable of survival for as long as infected stubble remains on the soil surface. Burial of stubble removes the ability of *B. cinerea* to produce spores in the air which can be blown around, and increases the rate of stubble breakdown by soil microbes.

  Although burning of infected residues will also significantly reduce the amount of infected residues on the soil surface, it will not guarantee freedom from BGM in the following season.

  Burying or burning stubble can significantly increase the risk of soil erosion and reduce water infiltration.

- **Volunteer control:** (the green bridge)
  Volunteer chickpea plants growing in or near paddocks where BGM was a significant problem are a likely method of carry-over and must be managed by application of herbicide or cultivation.

  This will also reduce carryover of ascochyta.

- **Seed source:**
  Obtain seed from a commercial supplier, or from a source known to have negligible levels of BGM. Irrespective of the source, all seed must be thoroughly treated with a registered fungicide seed dressing.

- **Seedling Emergence:**
  Research on 2010 harvested seed has shown a germination test does not accurately predict emergence. Accordingly, growers are advised to conduct their own emergence test, as follows.

  After grading and treatment, sow 100 seeds at least 5cm deep in the 2011 paddock that you intend for chickpeas and water if necessary. Count the number of seedlings that have emerged after one, two and three weeks and note their appearance. Do they look healthy or are they stunted and distorted.

  If you want to get an idea of variability in emergence and the paddock, replicate the test i.e. sow 100 seeds in 3-4 different locations in the paddock. This will also help identify potential herbicide residue problems.

- **Seed fungicides (dressings):** (Table 2)
  Thiram based fungicide seed dressings are effective in significantly reducing, but not entirely eliminating, BGM from infected seed.

- **Paddock selection:**
  Paddocks in which chickpeas were affected by BGM should not be re-sown to chickpea, faba bean or lentil the following season. Nor should chickpea be sown beside paddocks where BGM was an issue the previous season.

  As for ascochyta blight, chickpeas should be grown as far away from paddocks in which BGM was a problem as is practically possible.

  However, under conducive conditions, this practice will not guarantee that crops will remain BGM free, because of the pathogens wide host range, ability to colonise dead plant tissue, and the airborne nature of its spores.

- **Sowing time and row spacing:**
  If long-term weather forecasts suggest a wetter-than-normal year (La Nina) consider sowing in the later part of the suggested sowing window for your district and on wider rows (e.g. 100 cm); the latter results in increased air movement through the crop and reduced humidity within the canopy

- **Varietal Resistance:** (Table 1)
  All current commercial varieties suitable for the northern region are susceptible to BGM, although Howzat is reported to have slightly better resistance than other varieties.

  Observations in 2010 suggested that Almaz had less BGM than nearby varieties. However it is not know if this reflects genetic resistance/tolerance or disease escape (resulting from Almaz canopy architecture).

- **Foliar fungicides:** (Table 3)
  In areas outside central Queensland, spraying for BGM is not needed in most years.

  However, in seasons and situations favourable to the disease, a preventative spray of a registered fungicide immediately prior to canopy closure. Followed by another application 2 weeks later will assist in minimising BGM development in most years.

  If BGM is detected in a district or in an individual crop particularly during flowering or pod fill, a fungicide spray should be applied before the next rain event.

  None of the fungicides currently registered or under permit for the management of BGM on chickpea have eradicant activity, so their application will not eradicate established infections.

  Consequently, timely and thorough application is critical.

Table 1: Resistance ratings[#] of some northern region varieties to *Ascochyta, Phytophthora* and *Botrytis*.

Variety	Ascochyta	Phytophthora	Botrytis
PBA HatTrick[◊]	MR/R	MR	S
Flipper[◊]	MR	MS	S
Yorker[◊]	MS/MR	MR	S
Howzat	S	MS	MS
Jimbour	S	MS/MR	S
Kyabra[◊]	S	MS	S
Moti[◊]	VS	MS	MS
Genesis™ 090	R	VS	S
Genesis™ 425	R	MS	S
Almaz	MS/MR	VS	S

Resistance ratings are for low-moderate disease pressure situations.
In a season such as 2010 when repeated cycles of infection occur, even MR varieties can have yield-reducing levels of disease

Table 2: Seed dressings registered for the control of seed borne ascochyta blight and botrytis grey mould.

Active Ingredient	Example trade name	Rate (per 100 kg seed)
thiram (600 g/L)	Thiraflo®	200 mL
thiram (800 g/kg)	Thiragranz®	150 g
thiram + thiabendazole (360 + 200 g/L)	P-Pickel T®	200 mL

Refer to the current product label for complete 'Direction For Use' prior to application.

Table 3: Foliar fungicides for the control of ascochyta blight and botrytis grey mould.

Active Ingredient	Example trade name	Rate	
		Ascochyta blight	Botrytis Grey Mould
Chlorothalonil (720 g/L)	Crop Care Barrack® 720# Barrack Betterstick®# Nufarm Unite® 720#	1.0 – 2.0 L/ha	Not Registered
Mancozeb (750 g/kg)	Dithane™ Rainshield™	1.0 – 2.2 kg/ha	1.0 – 2.2 kg/ha
Mancozeb (420 g/L)	Penncozeb® SC	1.8 – 3.95 L/ha	Not Registered
Carbendazim (500 g/L)	Spin Flo®	Not Registered	500 mL/ha

These are the only registered chlorothalonil products. It is an offence to use any other product.
Refer to the current product label for complete 'Direction For Use' prior to application.

Further reading

Pulse Australia – Northern Pulse Bulletins;

- *Chickpea: Sourcing High Quality Seed*
- *Chickpea: Effective Crop Establishment*
- *Chickpea: Integrated Disease Management*
- *Chickpea: Ascochyta Blight Management*
- *Chickpea: Phytophthora Root Rot Management*
- *Central & Coastal Qld Ascochyta Management*

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