Northern Pulse BULLETIN
PA 2011 #08

Chickpea: Integrated Disease Management

Mal Ryley[1], Gordon Cumming[2]. Kevin Moore[3]
[1] Department of Employment, Economic Development and Innovation, [2] Pulse Australia, [3] Industry & Investment NSW

Summary

- *Disease management in chickpeas is critical and relies heavily on an integrated management package involving paddock selection, variety choice, strategic fungicide use and crop hygiene.*
- *Paddock selection on the basis of Phytophthora root rot is the first priority followed by cropping history. The appropriate Ascochyta blight control strategy is then adopted by determining the level of risk in combination with climatic conditions and the level of resistance afforded by the variety chosen.*
- *Disease control strategies may not be economic in high risk situations if Ascochyta blight susceptible varieties are grown.*

Four major fungal diseases regularly impact on chickpea crops in the northern GRDC region. These are Ascochyta blight (caused by *Ascochyta rabiei*), Botrytis grey mould (BGM; caused by *Botrytis cinerea*), Phytophthora root rot (PRR; caused by *Phytophthora medicaginis*) and Sclerotinia rot (caused by *Sclerotinia sclerotiorum* and *Sclerotinia minor*).

These are controlled through the use of Integrated Disease Management (IDM), which can be defined as the use of a range of disease management practices to reduce the impact of plant diseases. Used alone, an individual management practice may not reduce the level of disease to an acceptable level, whereas the additive effect of several practices will.

Regular crop monitoring to detect early disease outbreaks is vitally important for the success of IDM.

The three aims of Integrated Disease Management (IDM) are:

1. **Reduction of inoculums;** (the disease causing structures e.g. spores, cells, sclerotes) through careful paddock selection, control of volunteer and alternative hosts and stubble management.
2. **Exclusion of the pathogen;** through the use of clean seed, farm and paddock hygiene.
3. **Protection of the host;** through the use of varietal resistance and fungicides.

1. Reduction of inoculum

Paddock Selection

Selection of the most appropriate paddock for growing chickpea requires consideration of previous cropping history (rotation), the history of diseases on previous crops, proximity to previous crop residues and herbicide history.

- **Paddock history:** Aim for a break of at least 3-4 years between chickpea crops. Assess the risk of phytophthora root rot prior to sowing. Paddocks with a history of phytophthora in chickpeas, medics or lucerne are extremely risky and should be avoided.
- **Avoid poorly drained paddock:** There are both direct and indirect effects from phytophthora root rot and waterlogging.

  Observations in 2010 indicated that the natural resistance all plants have to pathogens and pests is compromised when plants are stressed from waterlogging and that this reduced the ability to manage ascochyta blight with a fungicide strategy that worked in less stressed crops.
- **Paddock isolation:** Sowing chickpea crops well away from chickpea stubble is a high priority. Aim for a separation of at least 500 m (further is better) from the previous year's chickpea paddocks.
- **Herbicide history:** Plants weakened by herbicide injury are more susceptible to diseases.

  The most common problem comes from residual herbicides applied to cereal crops in the preceding 12 months including Sulfonylurea (Group B), triazine (Group C), or Group I (eg Lontrel, Tordon 75D).

  The presence of these herbicide residues in soil may cause crop damage, making in-field disease diagnosis difficult.

Control of volunteers and alternative hosts
(the green bridge)
Ascochyta blight can increase rapidly on volunteer chickpeas as well as being a host for botrytis, sclerotinia, and phytophthora and must be removed. Weeds and other alternative hosts for botrytis, sclerotinia, and phytophthora also need to be controlled through the use of herbicides or cultivation.

Stubble management
The ascochyta and botrytis pathogens are likely to remain viable for as long as infected stubble remains on the soil surface. Burying stubble removes the ability of these pathogens to release spores and increases the rate of stubble breakdown. Although burning chickpea stubble will significantly reduce the amount of infected residues, it will not guarantee freedom from ascochyta or botrytis when chickpeas are next grown in that paddock. Stubble management is unlikely to have any major beneficial effect on sclerotinia or phytophthora.

Burying or burning stubble can significant adverse affect our farming systems, including loss of the organic nitrogen that is contained in the chickpea stubble (burning), increased risk of soil erosion and reduce water infiltration.

2. Exclusion of the pathogen

Seed quality
It is extremely important that seed is of the highest possible quality, irrespective of its source. Poor quality seed can result in low plant establishment due to poor germination, vigour and/or seed-borne diseases such as ascochyta blight and botrytis grey mould.

Using severely weather damaged or mechanically damaged seed will result in:

- Poor establishment and poor crop performance.
- Reduced plant vigour (increased susceptibility to soil-borne pathogens during establishment; increased susceptibility to foliar pathogens).
- Patchy, uneven plant stands (increased susceptibility to weed competition, aphids and viruses).
- Uneven plant development complicates in-crop management (e.g. herbicide applications).
- Uneven and delayed crop maturity (e.g. desiccation timing and mixed grain sample).
- Lower yields from a combination of all of the above.

Seed treatments
It is recommended that whenever possible seed should be obtained from a source where the crop was free from ascochyta and botrytis.

Seed infected with ascochyta and/or botrytis will often emerge but die within a few weeks, resulting in significant establishment losses and act as sources for crop infection of healthy plants.

All seed regardless of source should be treated with a registered thiram-based fungicide seed dressing prior to sowing (Table 2). Thiram-based fungicides are effective in significantly reducing, but not eliminating, damping off of seedlings from botrytis infected seed, and are extremely effective in reducing the risk from seedborne ascochyta. Although metalaxyl-based fungicides are registered for the control of phytophthora on chickpea seedlings, they are expensive and short-lived.

Kabuli chickpeas may show a response to the application of fungicide seed dressings even in the absence of known fungal diseases. This is because kabulis have a thinner seed coat than desi types and a lower content of phenolic compounds which helps protect the seed against fungal attack.

On and off-farm hygiene
Pathogens such as ascochyta and phytophthora can be transmitted in stubble, soil, on machinery and boots. Soil and stubble may be moved by machinery, during windy and/or wet weather, and in floodwater.

Therefore, it is essential that all harvesters and sowing equipment be thoroughly cleaned to remove grain, soil and stubble before moving from property to property and if possible between individual paddocks in high-risk disease situations.

The logistics of this practice may be difficult at harvest, but growers need to be aware that certain decisions on their or their contractor's part may increase the risk from certain diseases in the future.

Spray rigs, should also be cleaned to reduce the risk of disease transmission particularly if contractors are used.

3. Protection of the host

Varietal selection
Chickpea varieties in the northern GRDC region are susceptible to both *Sclerotinia* species, and all are susceptible to botrytis. However, there are varying levels of resistances to ascochyta and phytophthora (Table 1), with disease ratings being based on a combination of field and glasshouse assessments.

The disease reactions of individual varieties may vary from location to location and from season to season depending on the disease pressure. Weather conditions have a marked effect on both the host (e.g. stress) and the pathogen (e.g. survival, multiplication and spread).

The choice of variety will vary according to area, disease risk, harvestability issues, yield and marketing options. Consider sowing a variety with the highest levels of resistance to either or both ascochyta and phytophthora.

Row spacing
Consider wider rows (75-100 cm) as these increase air movement through the crop and lower humidity in the canopy. This reduces the number and duration of likely infection events for ascochyta, botrytis and sclerotinia. Wider rows are unlikely to have much impact on phytophthora and nematodes but may reduce (i) inter-row spread and (ii) the consequences of such diseases as plants are less likely to be stressed from lack of water in spring.

In crop fungicides
There are no in-crop fungicides registered on chickpea for phytophthora or sclerotinia, but several fungicides (Table 3) are registered for ascochyta and botrytis. Regular monitoring and timely application of fungicides are crucial for effective control. Applications need to be made just before the next rainfall event to effectively reduce disease spread. Of the 2 fungicides currently registered for ascochyta, chlorothalonil is better than mancozeb under high disease pressure.
None of the fungicides currently registered for chickpea ascochyta or botrytis have eradicant activity, so their use will not stop established infections. Consequently, timely and thorough applications are critical.

- **Fungicide control of ascochyta blight**:
  Detailed spray strategies have been developed for the control of ascochyta blight in chickpea based upon the varietal resistance.

  These are detailed in:

  Pulse Australia - Northern Pulse Bulletin;
  'Chickpea: Ascochyta Blight Management'

  The pods of ALL varieties (including Genesis™ lines with an R rating) are more susceptible to ascochyta than are leaves and stems. So protective sprays will be needed if ascochyta is present in the crop or neighbourhood once pod set has commenced.

- **Fungicide control of Botrytis grey mould:**
  A preventative spray of a registered fungicide before canopy closure, followed by another application two weeks later will help minimise botrytis in most years. If botrytis grey mould is detected in a district or in an individual crop, particularly during flowering or pod fill, a fungicide should be applied before the next rain event.

  For additional detailed information refer to:
  Pulse Australia – Northern Pulse Bulletin;
  'Chickpea: Botrytis Grey Mould Management'

Regular crop monitoring
Regular crop monitoring for the two main diseases ascochyta blight and botrytis grey mould is necessary for effective management. Inspections need to be undertaken in a range of locations in the paddock, preferably following a 'V' or 'W' pattern.

Inspect the crop 10-14 days after each rainfall event.

Ascochyta blight

Ascochyta blight, caused by the fungus *Ascochyta rabiei* (recently renamed *Phoma rabiei*), is a serious disease of chickpeas in Australia. The fungus can infect all above ground parts of the plant and is most prevalent in areas where cool, cloudy, humid weather occurs during the crop season.

Ascochyta rabiei first caused widespread damage to chickpeas in northern NSW and southern Qld in 1998 when extremely wet conditions favoured disease development and spread. Ascochyta blight is now considered to be endemic in all growing regions with the exception of central Queensland. Unlike some insect control strategies, there is no economic threshold for ascochyta. Management strategies are aimed at preventing the occurrence of disease and limiting its spread.

The disease is managed through crop rotation, hygiene, seed treatment, prophylactic fungicide application and growing varieties with improved resistance (Table 1).

All growers and advisors need to be regularly inspecting their crops from emergence through flowering right up to plant maturity. Inspections should be undertaken 10-14 days after rain events, when new infections will be clearly evident as lesions on plant parts.

A. rabiei can develop over a wide range of temperatures (5-30°C) and needs only 3 hrs of leaf wetness to infect. However, the disease develops fastest when temperatures are between 15-25°C and relative humidity is high (the longer the relative humidity is high, the more severe will be the infection).

Symptoms become visible in 4-5 days and pycnidia develop in 7-10 days. Subsequent in-crop infection occurs when spores are moved higher in the canopy or to surrounding plants by rain splash during wet weather. Multiple cycles of infection will occur during the growing season whenever environmental conditions are favourable.

Figure 1: Ascochyta blight lesions showing pycnidia. Photo: Gordon Cumming

Ascochyta blight management strategies for individual crops vary considerably and are strongly influenced by cropping history, varietal resistance and weather conditions. The key to achieving cost effective management of ascochyta blight is to assess the risk level for each paddock, and then manage accordingly.

Different fungicide spray programs have been developed and are based on each variety's ascochyta rating (Table 1).

For additional detailed information refer to:

* Pulse Australia – Northern Pulse Bulletin; *'Chickpea: Ascochyta Blight Management'*

Chickpea ascochyta fungicides are protectants only; unlike wheat stripe rust fungicides, they have no systemic or kick-back action so will not eradicate an existing infection. To be effective they must be applied before infection events i.e. before rainfall.

The key to a successful ascochyta spray program therefore is regular monitoring combined with timely application of registered fungicides (Table 3).

Botrytis grey mould (BGM)

Botrytis grey mould caused by the fungus *Botrytis cinerea* is present in all production areas but is more prevalent in the humid and warmer regions.

Botrytis can attack the plant at any growth stage. As seedling blight it can reduce plant establishment significantly if infected seed is sown without a fungicide seed dressing (Table 2).

Later in the season significant crop losses can occur during wet spring conditions, when a combination of canopy closure, frequent rainfall events and overcast weather results in prolonged periods of plant wetness. This results in high relative humidity and rapid leaf death within the canopy, along with moderate temperatures (20-25°C) these conditions are ideal for botrytis development and spread.

Control botrytis by using seed from disease free crops, applying a fungicides seed dressing, crop canopy management such as the use of wider rows (e.g. 100 cm) to allow for greater air movement and using protective foliar fungicides.

Spray programs for the control of ascochyta blight may also help to reduce the incident of stem and foliar botrytis grey mould.

However, the more ascochyta blight resistant varieties (PBA HatTrick$^{(b)}$, Flipper$^{(b)}$, Yorker$^{(b)}$) may require a fungicide spray program specifically for botrytis grey mould.

For additional detailed information refer to:

* Pulse Australia - Northern Pulse Bulletin; *'Chickpea: Botrytis Grey Mould Management'*

Phytophthora root rot (PRR)

Phytophthora is a soil and water-borne disease that can establish permanently in some paddocks.

Damage is greatest in seasons with above average rainfall. Development of the disease requires both the pathogen in the soil, and a period of soil saturation with water. Remember, only a single saturating rain event is needed for infection. Losses in a phytophthora-infested paddock may be minor if soil saturation does not occur.

Once a plant or crop is infected with phytophthora, there is nothing a grower can do. Unlike ascochyta and botrytis, crops cannot be sprayed with a fungicide to control phytophthora. Therefore the disease can only be managed by pre-sowing decisions.

The most effective control strategy is to not sow chickpeas in high-risk paddocks, which are those with a history of:

- Phytophthora in previous chickpea or lucerne crops.
- Lucerne or annual or perennial medics.
- Waterlogging or prone to flooding.

If considerations other than phytophthora warrant sowing in a medium/high-risk paddock, choose a variety with at least a moderate level of resistance (Table 1).

For additional detailed information refer to:

* Pulse Australia - Northern Pulse Bulletin; *'Chickpea: Phytophthora Root Rot Management'*

Viruses (several species)

Viruses can cause serious losses particularly in the higher rainfall areas such as the Liverpool Plains.

The risk of virus problems can be reduced by agronomic management practices including;

- Retention of cereal stubble to deter aphids.
- Sowing at recommended times to avoid autumn or spring aphid flights.
- Sowing at recommended rates to achieve early crop canopy closure (to deter aphids).
- Control broadleaf weeds that harbour viruses and their vectors.
- Distancing crops from lucerne or other green areas that can act as reservoir's for aphids.

For additional detailed information refer to:

* Pulse Australia - Northern Pulse Bulletin; *'Virus control in chickpea special considerations'*

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: Ascochyta Blight Management*
- *Chickpea: Botrytis Grey Mould Management*
- *Chickpea: Phytophthora Root Rot Management*
- *Central & Coastal Qld Ascochyta Management*
- *Virus control in chickpea special considerations*

For additional information contact

Mal Ryley – Principal Plant Pathologist DEEDI ph: 07 4688 1316 email: malcolm.ryley@qld.gov.au
Kevin Moore – Senior Plant Pathologist I&I NSW ph: 02 6763 1133 email: kevin.moore@industry.nsw.gov.au
Gordon Cumming – Pulse Australia, Northern Manager ph: 0408 923 474 email: pulse.gordon@bigpond.com
Leigh Jenkins – District Agronomist I&I NSW ph: 0419 277 480 email: leigh.jenkins@industry.nsw.gov.au
Jayne Gentry – Development Officer DEEDI ph: 0428 459 138 email: jayne.gentry@deedi.qld.gov.au

Major projects funded by
GRDC Grains Research & Development Corporation
Pulse Australia gratefully acknowledges the valuable financial support from our industry members.
These are listed on our website under the index heading "Members".