Northern Region GRDC GROWNOTES Tips and tactics

SUNFLOWER DISEASE MANAGEMENT

FEBRUARY 2015

Rotations affect disease outcomes. Optimise your farming system. Ready reckoner tables inside.

Successful sunflower production using integrated disease management

Effective disease management requires the selection and application of a number of complementary strategies to minimise crop losses and maximise sunflower yield and oil quality.

KEY POINTS

- Integrated disease management in sunflower requires implementation of sound farm hygiene, effective paddock rotations, appropriate agronomic and chemical practices, and the use of disease resistant hybrids where available.
- An understanding of the diseases of sunflower, the source of pathogen inoculum, methods of spread, symptoms of infection, and the potential impacts of environment and management options on yield and quality is essential.
- Use sunflower in rotations to manage diseases of other commonly grown northern region crops.

Figure 1: Field identification of disease can be challenging as visual symptoms can be similar; (left to right) stem lesions on sunflower resulting from Phoma are usually black and shield-shaped at the nodes; Phomopsis lesions can appear light brown to brown in appearance, sometimes with a darker irregular shaped edge; TSV can exhibit black streaks on the stem. (Photos: Sue Thompson, Murray Sharman).

Integrated disease management

Integrated disease management (IDM) considers the host, the pathogen and the environment which together determine the likelihood, extent and severity of disease infestations. IDM strategies include:

- Reducing or avoiding pathogen build up;
- Planting sunflower varieties or other non-hosts which are resistant to major pathogens; and
- Where possible managing or avoiding environmental conditions favouring outbreaks.

IDM focuses on the whole farm, not only on a single crop or field, and should be implemented regardless of whether or not a significant problem exists.

For more information on best practices for sunflower production, see the GrowNotes, a comprehensive online resource. Visit www.grdc.com.au/GrowNotes.

Disease awareness

Monitor crops for disease symptom

Underpinning IDM is an understanding of the pathogens of all crops grown on the farm – not just sunflower.

- Best practice recommends walking through the crop in a "W" pattern to minimise the risk of missing disease hotspots and to gauge any edge effects or disease gradients.
- Regularly check your crop for anything unusual and obtain a second opinion if unsure of an accurate diagnosis.
- Record results of crop monitoring to determine if the incidence or severity of disease outbreaks is increasing or decreasing within and between seasons.
- Ensure that you have current information on the frequency and biology of disease outbreaks in your region.
- Attend local field days, updates and workshops.

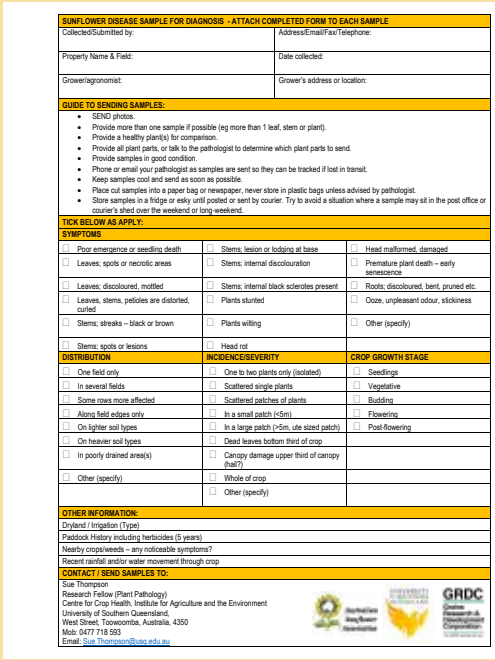
Obtain an accurate diagnosis

Diagnosing the cause(s) of a plant disease or disorder is not always quick or easy. The visual expression of symptoms can vary according to plant growth stage, weather conditions, and disease lifecycle; on occasion, multiple causal organisms may be present. A number of sunflower diseases such as Phomopsis stem canker (*Diaporthe/Phomopsis* spp.), Phoma black stem (*Phoma* spp.) and Tobacco streak virus (TSV) can exhibit similar visual symptoms (see Figure 1). TSV can also be confused with herbicide injury.

Farm hygiene

"Come Clean, Go Clean" is a critical strategy to prevent and minimise disease from entering your farm or moving between fields. Ensure that all vehicles, machinery, and people coming on to your farm are clean from soil and plant matter as many pathogens survive in residues and are easily spread.

On-farm hygiene is equally important as weeds and sunflower volunteers can host many pathogens, while non-host crops are planted or during fallows (See Figure 2).



SUNFLOWER DISEASE SAMPLE FOR DIAGNOSIS - ATTACH COMPLETED FORM TO EACH SAMPLE

Collected/Submitted by:	Address/Email/Fax/Telephone:
Property Name & Field:	Date collected:
Grower/agronomist:	Grower's address or location:

GUIDE TO SENDING SAMPLES:

- SEND photos.
- Provide more than one sample if possible (eg more than 1 leaf, stem or plant).
- Provide a healthy plant(s) for comparison.
- Provide all plant parts, or talk to the pathologist to determine which plant parts to send.
- Provide samples in good condition.
- Phone or email your pathologist as samples are sent so they can be tracked if lost in transit.
- Keep samples cool and send as soon as possible.
- Place cut samples into a paper bag or newspaper, never store in plastic bags unless advised by pathologist.
- Store samples in a fridge or esky until posted or sent by courier. Try to avoid a situation where a sample may sit in the post office or courier's shed over the weekend or long-weekend.

TICK BELOW AS APPLY:

SYMPTOMS

☐ Poor emergence or seedling death	☐ Stems; lesion or lodging at base	☐ Head malformed, damaged
☐ Leaves; spots or necrotic areas	☐ Stems; internal discolouration	☐ Premature plant death – early senescence
☐ Leaves; discoloured, mottled	☐ Stems; internal black sclerotes present	☐ Roots; discoloured, bent, pruned etc.
☐ Leaves, stems, petioles are distorted, curled	☐ Plants stunted	☐ Ooze, unpleasant odour, stickiness
☐ Stems; streaks – black or brown	☐ Plants wilting	☐ Other (specify)
☐ Stems; spots or lesions	☐ Head rot	

DISTRIBUTION	INCIDENCE/SEVERITY	CROP GROWTH STAGE
☐ One field only	☐ One to two plants only (isolated)	☐ Seedlings
☐ In several fields	☐ Scattered single plants	☐ Vegetative
☐ Some rows more affected	☐ Scattered patches of plants	☐ Budding
☐ Along field edges only	☐ In a small patch (<5m)	☐ Flowering
☐ On lighter soil types	☐ In a large patch (>5m, ute sized patch)	☐ Post-flowering
☐ On heavier soil types	☐ Dead leaves bottom third of crop	
☐ In poorly drained area(s)	☐ Canopy damage upper third of canopy (hail?)	
☐ Other (specify)	☐ Whole of crop	
	☐ Other (specify)	

OTHER INFORMATION:

Dryland / Irrigation (Type)
Paddock History including herbicides (5 years)
Nearby crops/weeds – any noticeable symptoms?
Recent rainfall and/or water movement through crop

CONTACT / SEND SAMPLES TO:

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For more information on sampling sunflowers for disease testing, see https://bettersunflowers.com.au/documents/access/docs.ashx?id=151

Need help?

- Contact a plant pathologist or agronomist for advice. See page 12 for details.
- Photograph individual plant symptoms; separate stems and root samples; note leaf symptoms; make sure one photograph provides a site overview to give context.
- Available on **www.bettersunflowers.com.au**, the Sunflower Disease Enquiry Sheet provides a guide for sample storage and transport, and the information needed for an accurate diagnosis.

Figure 2. Hard black sclerotes (Sclerotinia spp.) inside a dead thistle stem (left) and sunflower (right). (Photos: Sue Thompson)

Inoculum reduction and crop management strategies

Rotate crops and know the paddock history

Crop rotation is an essential strategy to manage disease. Best practice IDM avoids planting back-to-back crops or planting into high risk paddocks, which are those with a history of disease. Table 1 provides a guide to survival and spread of most common sunflower diseases and the relative risks and disease implications of rotation crops following sunflower.

Some common soil-borne pathogens such as Sclerotinia rot (caused by *S. minor* & *S. sclerotiorum*) and Sclerotium base rot (caused by *Sclerotium rolfsii*) can survive in the soil and in plant residues for many years. The only control method available for these pathogens is to rotate to a non-susceptible crop, and control potential weed and volunteer hosts.

Figure 3. Be aware of paddock history when making planting decisions; Sclerotinia stem and base rots have an extensive host range, including chickpea (pictured left), sunflower (right) and many other broad leaf crops, and can survive in the soil and stubble for many years (See Table 1). (Photos: Sue Thompson).

Table 1: Disease implications of rotation crops following sunflower

	Alternaria blight *(Alternaria helianthi)*	**Phomopsis stem canker** *(Diaporthe/Phomopsis* species*)*	**Powdery mildew** *(Golovinomyces cichoracearum)*	**Rhizopus head rot** *(Rhizopus* species)
Spread	Airborne spores, infected residues.	Infected residues, seed	Airborne spores	Airborne spores
Survival	Infected sunflower residues, living sunflower volunteers & wild sunflowers.	Seed, infected sunflower and other host residues, living volunteer & weed hosts.	Needs a live plant for survival such as sunflower volunteers, wild sunflowers, some other Asteraceae.	Residues of many plants - opportunistic coloniser of damaged tissue.
Barley	Non-host	Non-host*	Non-host	Non-host
Canola	Non-host	Non-host*	Non-host	Non-host
Chickpea	Non-host	Possible host of some species under favourable conditions. Be aware of disease levels in previous crops.	Non-host	Non-host
Cotton	Non-host	Non-host*	Non-host	Non-host
Faba bean	Non-host	Non-host*	Non-host	Non-host
Fallow	Incorporate infected residues early.	Incorporate infected residues early.	Control sunflower volunteers, wild sunflowers and other hosts.	*Rhizopus* species are common in nature. Be aware of disease levels in previous crops.
Maize	Non-host	Non-host*	Non-host	Non-host
Mungbean	Non-host	Possible host of some *Diaporthe* species under favourable conditions. Be aware of disease levels in previous crops.	Non-host	Non-host
Oats	Non-host	Non-host*	Non-host	Non-host
Peanuts	Non-host	Non-host*	Non-host	Non-host
Pigeon pea	Non-host	Non-host*	Non-host	Non-host
Safflower	Non-host	Possible host of some *Diaporthe* species under favourable conditions. Be aware of disease levels in previous crops.	Possible host under favourable conditions. Airborne spores travel long distances.	Non-host
Sorghum	Non-host	Non-host*	Non-host	Non-host
Soybean	Non-host	Possible host of some species under favourable conditions. Be aware of disease levels in previous crops	Non-host	Non-host
Sunflower (back to back)	**Incorporate infected residues, control sunflower volunteers, rotate with other crops.**	**Incorporate infected residues, control weeds and volunteers, rotate with non-host crops.**	**Host. Does not survive on stubble. Control volunteers and other living hosts.**	**Control insects to minimise damage to heads.**
Wheat	Non-host	Non-host*	Non-host	Non-host

Low risk *Caution* *High risk*

** Note: Diaporthe/Phomopsis species - although many crops are listed as non-hosts, Diaporthe/Phomopsis spp. have a saprophytic and/or endophytic phase and may be capable of infecting live plants or stubble of most plants (including so called non-hosts)*

Table 1: Disease implications of rotation crops following sunflower (continued)

	Sunflower rust *(Puccinia helianthi)*	**Sclerotinia base, stem and head rot** *(Sclerotinia minor & S. sclerotiorum)*	**Sclerotium base rot** *(Sclerotium rolfsii)*	**Tobacco streak virus** (TSV)
Spread	Airborne spores	Sclerote-infected host residues, soil and seed.	Sclerote-infected host residues and soil.	Transmitted by thrips in pollen of infected weed hosts, seedborne in parthenium weed.
Survival	Live sunflower volunteers & wild sunflowers. Telia stage can survive on crop residues.	Survival in infected host residues, soil, and live broadleaf crop and weed hosts.	Survival in infected host residues, soil, and live crop and weed hosts.	Live volunteer and weed hosts, particularly parthenium weed.
Barley	Non-host	Non-host	Minor host. Be aware of disease levels in previous crops.	Non-host. Control parthenium weed, maintain farm hygiene.
Canola	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Non-host. Control parthenium weed, maintain farm hygiene.
Chickpea	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Minor host. Be aware of disease levels in previous crops.	Minor host. Control parthenium, maintain farm hygiene.
Cotton	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Faba bean	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Fallow	Control sunflower volunteers & wild sunflower plants. Incorporate infected residues.	Incorporate infected residues, maintain farm hygiene, control hosts.	Incorporate infected residues, maintain farm hygiene, control hosts.	Non-host. Control parthenium, maintain farm hygiene.
Maize	Non-host	Non-host	Minor host. Be aware of disease levels in previous crops.	Non-host. Control parthenium weed, maintain farm hygiene.
Mungbean	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Oats	Non-host	Non-host	Minor host. Be aware of disease levels in previous crops.	Non-host. Control parthenium weed, maintain farm hygiene.
Peanuts	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Pigeon pea	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Safflower	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Sorghum	Non-host	Non-host	Minor host. Be aware of disease levels in previous crops.	Non-host. Control parthenium weed, maintain farm hygiene.
Soybean	Non-host	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/winter cereal crops.	Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.	Minor host. Control parthenium, maintain farm hygiene.
Sunflower (back to back)	**Control sunflower volunteers & wild sunflower plants. Incorporate infected residues. Plant rust resistant hybrids.**	**Incorporate infected residues, maintain farm hygiene, control hosts, rotate with summer/ winter cereal crops.**	**Incorporate infected residues, maintain farm hygiene, control hosts, rotate with non-host crops.**	**Plant tolerant varieties, maintain farm hygiene, avoid planting upwind of major parthenium infestations.**
Wheat	Non-host	Non-host	Minor host. Be aware of disease levels in previous crops.	Non-host. Control parthenium weed, maintain farm hygiene.

Low risk *Caution* *High risk*

Control alternative hosts

Live weeds and volunteers provide a green bridge for pathogens and insect vectors. Pathogens such as *Sclerotinia* spp causing Sclerotinia base, stem and head rots are known to have an extensive host range of more than 500 crop and weed species including most broad leaf crops (see Figure 3). Some *Phomopsis* species have multiple crop and weed hosts including wild sunflowers which also host sunflower rust and alternaria blight. Controlling alternative hosts is particularly important for managing viruses. Currently found only in Central Queensland, TSV is transmitted via the infected pollen carried by thrips from the weed hosts parthenium (*Parthenium hysterophorus*) and crownbeard (*Verbesina enclioides*).

Alternative weed hosts surviving on non-cropping areas such as waterways, fencelines and roadsides are also a reservoir for inoculum and insect pests.

Be aware that host or alternative host plants may be asymptomatic (not display symptoms); for example, parthenium weed and crownbeard do not display symptoms of being infected with TSV. Charcoal rot is often present as a latent infection in roots and stem bases but does not cause yield loss unless the plants become stressed.

Manage plant residues

Crop residues (stubble) aid the survival of many plant pathogens. Knowledge of the mode(s) and length of survival of the pathogen should guide disease management strategies. Diseases such as Powdery mildew and Rhizopus head rot do not survive in plant residues whereas Sclerotinia rot can survive for 5-10 years depending on conditions and Phomopsis stem canker may survive for at least three years in unburied stubble (see Figure 4). Strategic burial of infected plant residues should be considered as a management tool to minimise pathogen survival and increase the speed of inoculum breakdown.

Stubble management

Stubble aids the survival of multiple pathogens including *Phomopsis* stem canker, *Sclerotina* spp., *Fusarium* spp., *Macrothomina phaseolina* (charcoal rot) and *Sclerotium rolfsii* (pictured Figure 7).

For the latest see Sue Thompson's paper: **https://bettersunflowers.com.au/documents/access/docs.ashx?id=74**

Figure 4. Viable small black fruiting bodies (pycnidia) of Phomopsis stem canker have been observed on weeds and crop stubble more than 29 months after sunflower harvest. Pycnidia may be visible in lesions using a hand lens. (Photos: Sue Thompson).

Chemical control

Most diseases do not have chemical control options; Powdery Mildew is an exception. The fungicide TILT250EC® (propiconazole) can be used to control Powdery mildew under permit. Permit requirements must be observed to ensure that chemical residues are not detected in the end products. No other fungicides are registered for use in sunflower, however mancozeb products (e.g. #59516) registered for use in sunflowers for parent and hybrid seed production for rust; and thiram products (e.g. #58072) are registered for use in sunflower seeds for export only to meet export requirements.

In trials, under conditions of moderate disease pressure, TILT250EC® applied once at a rate of 500mls/ha at 5% RFE provided good protection of the top third of the canopy as well as giving good powdery mildew control in the middle third of the canopy. This rate of TILT250EC® applied once as early as bud initiation also successfully protected the crop until physiological maturity.

The impacts on yield from powdery mildew will depend on the severity and timing of infection. Powdery mildew can move rapidly up the plant under favourable conditions so regular crop monitoring is vital (see Figure 5). Fungicide application may not be required if the top third of the sunflower leaf canopy remains clean, or if infection occurs as the plant reaches physiological maturity.

Product	Active	Rate	Permit Number and Expiry	Timing
TILT250EC®	propiconazole	250 – 500 mls/ha or 200 - 300 mL/ha, when spray volume is less than 800 L/ha	Permit Number PER14777 Expiring 30 June 2016	Apply **no later** than 5% ray floret emergence (RFE) (i.e. 5 heads in 100 are showing yellow ray petals)

For more information on powdery mildew in sunflower see: **http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2008/07/POWDERY-MILDEW-IN-SUNFLOWERS-YIELD-IMPACTS-AND-MANAGEMENT**

Figure 5. Powdery mildew fungal colonies first appear on the lowest leaves as powdery, greyish white spots on the upper leaf surface, and can rapidly develop from mild to epidemic proportions under ideal conditions of cool weather and high humidity. (Photo: Sue Thompson).

Control insects

Insect vectors or damage from insect feeding can sometimes allow disease pathogens entry into the sunflower plant (Figure 6). In the case of Rhizopus head rot (*Rhizopus* spp.), infection occurs through wounds in the plant tissues that are caused by hail, birds or insects – particularly *Helicoverpa* species. Losses can range from minimal to severe, but are more likely to occur when insect and bird damage is extensive. To minimise Rhizopus head rot infestation, regular crop monitoring for insects is critical. Insect control should be made according to thresholds, label requirements and IPM considerations.

TSV transmission from infected weed hosts to sunflowers requires the pollen covered thrip to transfer the virus into the sunflower plant via leaf damage caused by scarification of the leaf during feeding.

Use resistant varieties

Planting resistant or tolerant varieties is another component of IDM that can be used to manage diseases. Research has shown that TSV no longer poses a serious threat to the sunflower industry in central Queensland when tolerant hybrids are used and potential disease sources around crops are minimised. Central Queensland growers have access to a range of tolerant sunflower hybrids.

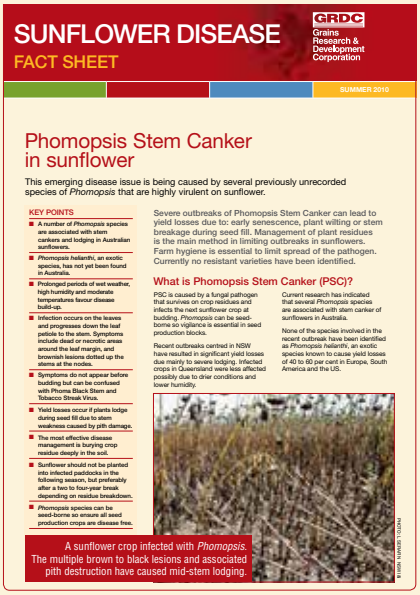
Red rust (caused by *Puccinia helianthi*) is not often observed in sunflower due to durable resistance in commercially available hybrids (see Figure 6). Vigilance and careful selection of hybrids is essential to minimise inoculum buildup. Contact the seed company representative or pathologist for further information on susceptible varieties.

Assessment of sunflower hybrids for tolerance to Phomopsis stem canker is ongoing. Early results, which support overseas trial results, indicate that severity of infection can be associated with maturity types; shorter season hybrids were generally more susceptible and senesced more rapidly than many of the longer season varieties.

Crop agronomy and plant characteristics

Varying crop agronomy and plant characteristics can impact on sunflower pathogens. Very high plant populations can increase the severity of disease outbreaks. Mid-stem lodging caused by Phomopsis stem canker is more likely to occur in thinner stemmed plants as the plants reach maturity and the weight of the head increases. A high vegetative biomass can result in a high humidity micro-environment within the crop canopy which favours Powdery Mildew and the germination of *Sclerotinia* species sclerotes.

Following best agronomic practice for nutrition, plant population, row spacing and herbicide applications will produce a healthy plant more able to express its natural resistance to disease.


SUNFLOWER DISEASE
FACT SHEET
GRDC Grains Research & Development Corporation
SUMMER 2010

Phomopsis Stem Canker in sunflower

This emerging disease issue is being caused by several previously unrecorded species of *Phomopsis* that are highly virulent on sunflower.

KEY POINTS

- A number of *Phomopsis* species are associated with stem cankers and lodging in Australian sunflowers.
- *Phomopsis helianthi*, an exotic species, has not yet been found in Australia.
- Prolonged periods of wet weather, high humidity and moderate temperatures favour disease build-up.
- Infection occurs on the leaves and progresses down the leaf petiole to the stem. Symptoms include dead or necrotic areas around the leaf margin, and brownish lesions dotted up the stems at the nodes.
- Symptoms do not appear before budding but can be confused with Phoma Black Stem and Tobacco Streak Virus.
- Yield losses occur if plants lodge during seed fill due to stem weakness caused by pith damage.
- The most effective disease management is burying crop residue deeply in the soil.
- Sunflower should not be planted into infected paddocks in the following season, but preferably after a two to four-year break depending on residue breakdown.
- *Phomopsis* species can be seed-borne so ensure all seed production crops are disease free.

Severe outbreaks of Phomopsis Stem Canker can lead to yield losses due to: early senescence, plant wilting or stem breakage during seed fill. Management of plant residues is the main method in limiting outbreaks in sunflowers. Farm hygiene is essential to limit spread of the pathogen. Currently no resistant varieties have been identified.

What is Phomopsis Stem Canker (PSC)?

PSC is caused by a fungal pathogen that survives on crop residues and infects the next sunflower crop at budding. *Phomopsis* can be seed-borne so vigilance is essential in seed production blocks.

Recent outbreaks centred in NSW have resulted in significant yield losses due mainly to severe lodging. Infected crops in Queensland were less affected possibly due to drier conditions and lower humidity.

Current research has indicated that several *Phomopsis* species are associated with stem canker of sunflowers in Australia.

None of the species involved in the recent outbreak have been identified as *Phomopsis helianthi*, an exotic species known to cause yield losses of 40 to 60 per cent in Europa, South America and the US.

A sunflower crop infected with *Phomopsis*. The multiple brown to black lesions and associated pith destruction have caused mid-stem lodging.

PHOTO: SUSAN WHITE

For more information on Phomopsis stem canker in sunflowers, see http://www.grdc.com.au/uploads/documents/GRDC_FS_Sunflowerdisease.FINAL.pdf

Figure 6. Insect vectors or damage from insect feeding, hail or birds can allow pathogens to enter the plant. Rhizopus head rot damage (left and bottom right). Brown/black stem TSV discoloration and twisting spread by thrips (top right). (Photos: Sue Thompson and Murray Sharman.)

Figure 7. Many growers and advisers have never seen rust infection but should remain alert for this potentially serious pathogen observed as small reddish-brown pustules on both the upper and lower leaf surfaces, and sometimes on leaf petioles and flower bracts. (Photo: Sue Thompson.)

Be aware of environmental factors

Weather conditions affect both the host and the pathogen. Growers can make choices on planting date, and if relevant, irrigation management, to reduce the risks of unfavourable plant growth conditions. Be aware of the planting window recommended for your region, as a stressed crop is more likely to be colonised by pathogens.

Irrigation management can be used to manipulate the crop environment. Waterlogging events during grain filling can increase incidences of pests and diseases and impair physiological processes. The type and timing of irrigation can impact on inoculum germination and the speed of disease build-up.

Diseases such as Powdery mildew, Phomopsis stem canker, Alternaria blight, Rust, Sclerotinia rot and Sclerotium base rot (Figure 7) are favoured by overhead irrigation. Irrigators can minimise disease risks by irrigating in the morning to limit the build-up of humidity in the crop overnight. Using centre or lateral pivots that wet the entire crop canopy will encourage humidity build-up, so droppers for overhead irrigators should be used, if practical.

Understand infection conditions

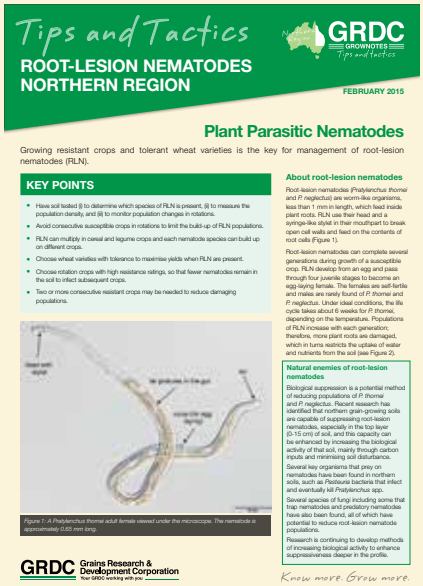
Every pathogen has specific environmental conditions that favour disease development. For example, conditions of sustained warm and wet weather favour the rapid development of diseases such as Alternaria blight (See Figure 7.) Knowledge of ideal infection conditions (day length, temperature, rainfall, humidity and wind) will help growers and advisers to accurately assess the risk of disease development.

Sunflower's role as a disease break crop

Just as sunflower is a host for some pathogens, it is also resistant to other common crop diseases. Sunflower can play an important role in managing significant soil and stubble borne pathogens of the northern region (Table 2).

Some IDM benefits of rotating to sunflower include:

- Resistance to the root lesion nematodes *P. thornei* and *P. neglectus*
- Does not host the wheat *Fusarium* crown rot pathogens
- Does not host the sorghum *Fusarium* stalk rot pathogens (See Figure 8)
- Does not host the chickpea Ascochyta blight (*Phoma rabiei*)


Tips and Tactics
GRDC GROWNOTES Tips and Tactics
ROOT-LESION NEMATODES NORTHERN REGION
FEBRUARY 2015
Plant Parasitic Nematodes
Growing resistant crops and tolerant wheat varieties is the key for management of root-lesion nematodes (RLN).
KEY POINTS
About root-lesion nematodes
Natural enemies of root-lesion nematodes
GRDC Grains Research & Development Corporation
Know more. Grow more.

For more information on the resistance of sunflowers to root lesion nematodes, see http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/08/Root-lesion-nematodes-cereal-variety-and-rotational-crop-impacts-on-yield-and-nematode-numbers

Figure 8. Alternaria leaf spot can show varying visual symptoms depending on the sunflower hybrid and severity of infection; Lesions on leaves may be surrounded by a yellow halo. Under favourable conditions lesions expand rapidly to form large dead areas, commonly described as blight (left). Sclerotium base rot (S. rolsii) is favoured by warm, wet conditions and survives in soil and stubble (right). (Photos: Sue Thompson, Murray Sharman)

Table 2. Disease risk of significant soil and stubble borne pathogens for crops of the northern region

	Root lesion nematode *(Pratylenchus thornei)*	**Root lesion nematode** *(Pratylenchus neglectus)*	**Fusarium head blight** *(Fusarium graminearum*)*	**Fusarium stalk rot and cob rot** *(Fusarium verticillioides*)*	**Fusarium wilt** *(Fusarium oxysporum* f.sp. *vasinfectum*)*	**Ascochyta Blight** *(Phoma rabiei* also known as *Ascochyta rabiei)*
Spread	From infested soil and in flood water	From infested soil and in flood water	Airborne spores, infected stubble, seed	Airborne spores, infected stubble, seed	Soil borne	Watersplashed spores, infected stubble, seed
Survival	Eggs, juveniles and adult stages in soil and root pieces	Eggs, juveniles and adult stages in soil and root pieces	Infected stubble, seed, alternative hosts, host volunteers	Infected stubble, seed, alternative hosts, host volunteers	Soil and residues	Infected stubble, seed, host volunteers; no alternative hosts
Barley	Moderately susceptible to moderately resistant	Moderately susceptible to moderately resistant	Susceptible	Non-host*	Non-host*	Non host
Canola	Resistant	Susceptible	Non-host*	Non-host*	Unknown	Non host
Chickpea	Susceptible	Susceptible	Non-host*	Non-host*	Non host*	Varieties differ in resistance
Cotton	Resistant	Resistant	Non-host*	Non-host*	Varieties differ in resistance	Non host
Faba bean	Susceptible	Resistant	Non-host*	Non-host*	Non-host*	Non host
Long fallow	Eggs, juveniles and adult stages in soil and root pieces	Eggs, juveniles and adult stages in soil and root pieces	Survives in infected stubble, weed hosts	Survives in infected stubble, weed hosts	Survives in infected stubble, soil, volunteers, weed hosts	Survives in infected stubble, volunteers
Maize	Resistant	Resistant	Causes stalk rot and cob rot	Causes stalk rot and cob rot	Non-host*	Non host
Mungbean	Susceptible	Resistant	Non-host*	Non-host*	Non-host*	Non host
Oats	Moderately resistant	Not tested	Recorded as suceptible overseas	Non-host*	Non-host*	Non host
Peanuts	Unknown	Unknown	Non-host*	Non-host*	Non-host*	Non host
Pigeon pea	Resistant	Unknown	Non-host*	Non-host*	Unknown	Non host
Safflower	Unknown	Unknown	Non-host*	Non-host*	Unknown	Non host
Sorghum	Resistant	Susceptible	Possible infection in wet years	Found occasionally in infected stalks	Non-host*	Non host
Soybean	Susceptible	Resistant	Non-host*	Non-host*	Non-host*	Non host
Sunflower	**Resistant**	**Resistant**	**Non-host***	**Non-host***	**Non-host***	**Non host**
Wheat	Susceptible to moderately resistant	Susceptible to moderately resistant	Susceptible	Non-host*	Non-host*	Non host

Low risk *Caution* *High risk*

** Note: Fusarium and Verticillium spp. - although many crops are listed as non-hosts, many Fusarium spp. have a saprophytic and/or endophytic phase and may be capable of infecting live plants or stubble of most plants (including so called non-hosts)*

*** Note: Macrophomina phaseolina is found in most soils and is capable of colonising the roots of many crop and weed plants without aboveground symptoms being displayed*

Table 2. Disease risk of significant soil and stubble borne pathogens for crops of the northern region (continued)

	Verticillium Wilt *(*Verticillium* spp.*)*	**Fusarium stalk rot and head blight** *(Fusarium* spp., mostly *F. thapsinum* and *F. andiyazi*)*	**Fusarium crown rot** *(Fusarium* spp., mostly *F. psuedograminearum*)*	**Charcoal rot** *(Macrophomina phaseolina)*	**Blackleg of Canola** *(Leptosphaeria maculans)*
Spread	Sclerote-infested soil, infected stubble	Airborne spores, infected stubble, seed	Airborne spores, infected stubble, soil	Infected stubble, soil	Airborne spores, infected stubble
Survival	Infected stubble, soil	Infected stubble, seed, alternative hosts, host volunteers	Infected stubble, seed, soil, alternative hosts, host volunteers	Infected stubble, soil, wide range of live crop & weed host plants	Infected stubble, host volunteers
Barley	Non host	Non-host*	Susceptible	Non host**	Non host
Canola	Non host	Non-host*	Non-host*	Non host**	Varieties differ in resistance
Chickpea	Non host	Non-host*	Non-host*	Non host**	Non host
Cotton	Risk is related to variety V rank. Incorporate residues.	Non-host*	Non-host*	Minor host, mostly dryland crops.	Non host
Faba bean	Non host	Non-host*	Non-host*	Non host**	Non host
Long fallow	Survives in infected stubble, soil, volunteers, weed hosts	Survives in infected stubble, volunteers, weed hosts	Survives in infected stubble, soil, grass weed hosts	Survives in infected stubble, soil and weed hosts	Survives in infected stubble, volunteers
Maize	Non host	Non-host*	Non-host*	Susceptible	Non host
Mungbean	Non host	Non-host*	Non-host*	Susceptible	Non host
Oats	Non host	Non-host*	Susceptible	Non host**	Non host
Peanuts	Susceptible	Non-host*	Non-host*	Minor host.	Non host
Pigeon pea	Non host	Non-host*	Non-host*	Minor host.	Non host
Safflower	Susceptible	Non-host*	Non-host*	Minor host.	Non host
Sorghum	Non host	Susceptible	Recorded in stubble	Susceptible	Non host
Soybean	Susceptible	Non-host*	Non-host*	Susceptible	Non host
Sunflower	**Varieties vary in tolerance**	**Non-host***	**Non-host***	**Susceptible**	**Non host**
Wheat	Non host	Non-host*	Susceptible, can cause head blight	Non host**	Non host

Low risk *Caution* *High risk*

** Note: Fusarium and Verticillium spp. - although many crops are listed as non-hosts, many Fusarium spp. have a saprophytic and/or endophytic phase and may be capable of infecting live plants or stubble of most plants (including so called non-hosts)*

*** Note: Macrophomina phaseolina is found in most soils and is capable of colonising the roots of many crop and weed plants without aboveground symptoms being displayed*

Figure 9. Sorghum stalk rot are caused by Fusarium spp., identifiable by characteristic pink discolouration (C). Macrophomina phaseolina (charcoal rot) presents as grey/black micro-sclerotes in the pith (right). These pathogens survive on stubble and may be seen as mixed infections (left) and cause lodging. Bleached sunflower stems infected with Macrophomina phaseolina (charcoal rot), a stress pathogen of both sunflower and sorghum (far right). (Photos: Sue Thompson)

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Useful Resources

- Sunflower Disease Management **www.bettersunflowers.com.au/bysp/disease**
- Sunflower Disease Enquiry Sheet **https://bettersunflowers.com.au/documents/access/docs.ashx?id=134**
- The Big Yellow Sunflower Pack, Module 4 Disease Management, AOF Better Sunflowers Agronomic manual, July 2012
- Summer Crop Production Guide, NSW DPI Management Guide, 2014 **http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/303485/Summer-crop-production-guide-2014.pdf**
- **Phomopsis Stem Canker in sunflower**, GRDC Fact Sheet, Summer 2010
- What is sunflower powdery mildew? GRDC Fact Sheet, August 2008
- Exotic Plant Pest Hotline **1800 084 881**

GRDC Project codes

- DAQ 000186 (GRDC), PAL 00019 (GRDC)

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