Stubble disease strategies

Overcoming disease management issues

- Use a range of strategies to keep disease inoculum levels low
- Select resistant varieties if they are available
- Rotation with non-host crops will keep crop yields high
- Fungicide treatments on seed or fertiliser and follow up foliar fungicide applications will give economic control for some diseases, but not others
- Burning stubbles will only give partial control of many diseases
- Inter-row sowing can help avoid contact with diseased residues
- Each of these diseases is different and needs different control approaches

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Overcoming disease management issues

Navigating diseases

Conservation farming systems have increased cropping productivity significantly but diseases that survive on stubble have confounded the benefits, and been an increasing problem in no-till and stubble retained systems. The plant growth inhibition of some soil microbes has also reduced seedling vigour and contradicts the theory that increasing biological activity by retaining residues, improves crop growth. Research has now shown that there are ways around this, using specific growth characteristics and disease resistance of some varieties, crop rotation with break crops and pastures, and chemical controls in some cases to limit the impact of these diseases.

Different management strategies apply to different diseases

Yellow Leaf Spot (YLS)

YLS is a fungus that survives as mycelia on cereal stubble and under wet conditions raindrops can splash spores onto the newly germinated seedlings nearby. Cereal stubble can remain infective for several years, so the risk of infection is increased if there is stubble carryover from previous crops, even from several years before. Once the disease is established on the young leaves the lesions develop and transfer the disease to the rest of the plant as it matures.

Cultural control methods include removal or burning stubble, use of resistant cultivars and improved crop sequencing with non-host crops such as canola and pulses. Barley does not show symptoms of YLS, but the stubble will host the disease and provide inoculum for the following crops. A useful crop sequence may be wheat, barley and then canola or pulse to run down the level of inoculum.

Use of fungicides early season may not be economic, but if wet conditions occur in spring then protecting the top leaves from disease will have yield benefits.

- Burn stubble just before sowing wheat if risk of YLS is high (old stubble with black spots showing after rain).
- Use resistant varieties.
- Rotations should have regular break crops (canola or pulses).

Crown Rot

Crown Rot is an important disease of all grass and cereal species, of particular importance in higher rainfall areas. A recent paddock survey in southern NSW showed crown rot was extensive, but many farmers and advisors had mistaken it for frost, take-all, drought or nutritional problems. Crown rot can cause high levels of infection in cereal crops from low initial levels of inoculum if wet soil conditions allow. The disease persists in crop residues both above and below ground.

Control is by using both cultural methods and breeding resistant varieties, as there is no chemical controls available. Burning stubble will destroy the above ground parts but inoculum survives on the roots and crowns left below ground, so this is often only a partial control method. Crop sequencing with break crops such as pulses and canola may be more profitable than wheat in paddocks with medium to high levels of residue. Inter-row sowing using wide row spacing that avoids physical contact with old roots and crowns will inhibit the spread of the disease, but again may not be economic in comparison with narrow rows in the high rainfall areas. In trying to use all tactics in an integrated disease management system it is noted that some resistant varieties may not yield as highly as susceptible varieties in the presence of the disease.

- Use of resistant varieties.
- Rotations with broadleaf break crops (canola and pulses).
- Inter-row sowing to avoid contact with old roots and residues.

Rhizoctonia

This fungal disease of cereals is found through many cropping areas and has increased as a result of no-till practice especially with continuous cropping. Increasing plant stress from poor seedling vigour (drought, low nutrient levels, herbicide toxicity) can also make plants more susceptible to this disease. Increasing soil disturbance below the seed with tined sowing points, earlier sowing to increase seedling vigour and use of fungicide treated seed all act to reduce the effect of this organism. Tillage is an effective control as it breaks down the fungal hyphae networks and using non-host crops such as canola, pulses, legume pastures and fallows will drive down inoculum levels. Use of PreDicta B® tests can identify high risk paddocks and allow controls to be applied.

Rhizoctonia control strategies

- Rotations using break crops such as canola, pulses and pasture phases.
- Occasional use of tillage to disturb soil especially along sowing furrows
- Earlier sowing to ensure vigorous seedlings
- Fungicide treated seed will give seedlings protection in the critical period.

Blackleg

This fungal disease of canola has been a serious problem and can cause major yield losses. The causal organism of blackleg carries over from season to season on canola stubble residues. Around 90% of spores that will infect crops have come from the previous year's stubble located nearby. Having a buffer zone of at least 500m between paddocks dramatically reduces disease pressure, but some spores can still travel up to 1-2 kilometres on the wind. A huge effort has been made to breed resistant varieties, and with use of seed or fertiliser treated with fungicide, good crop rotation and separation of each season's canola paddocks, the disease can be managed effectively. Varieties are grouped according to their resistance genes to blackleg, so should be rotated to a different group every three years to avoid the build-up of the blackleg pathogen population that can overcome variety resistance (see table below)

Blackleg control strategies

- Sow a different canola variety every three years with a high resistance rating
- Separate canola paddocks around the farm as far as possible (>500 metres)
- Use non host crops in the rotation (cereals and pulses)
- Use a fungicide seed dressing or fertiliser to give protection from early infections.
- Burning or removing stubble residue will marginally reduce, but not eliminate, inoculum

Sclerotinia Stem Rot

Sclerotinia stem rot is another fungal disease that has caused yield losses in canola and pulses, and will carry over from crop residues. The fungus which causes this disease has a broad range of hosts (over 400 species), including many common broadleaf crops and weeds, so care needs to be taken to check inoculum levels in paddocks.

The disease requires specific environmental conditions to develop and does not always occur. When it does develop, yields can be reduced significantly if good management practices are not observed. Prolonged wet conditions in late winter when canola is flowering favours development of the disease. The flower petals can capture airborne spores, become infected, fall into the crop canopy and cause stem infections if conditions are suitable. If the canopy is thick and there is poor airflow through the crop these lesions soon girdle the stems preventing the plant from translocating essential nutrients and moisture. It is not uncommon to see losses up to 35% in a bad year.

High rainfall areas, especially if rotations are limited to wheat and canola continuously, are prone to build up high levels of soil borne inoculum (sclerotia). These sclerotia are often resistant to burning, so other control tactics are needed. Several foliar fungicides are registered for management of Sclerotinia but timing applications to give protection of the stems is critical (best applied at 30 – 50 % bloom).

Photo 1 - Early development of a sclerotinia stem rot lesion.
Photo: K. Lindbeck, NSW DPI

Sclerotinia Stem Rot control strategies

- Longer rotations with non-host crops will reduce the levels of inoculum (sclerotia) in soils.
- Foliar fungicides are best applied at 30 – 50% bloom, prior to a rainfall event and development of symptoms. This will protect flowers and stems from infection.
- Prolonged periods of leaf wetness (at least 48 hours) during flowering will favour development of the disease, especially in districts where the disease frequently occurs.
- Burning crop residues will not destroy all the fungal sclerotia.

Table 2015 Spring Blackleg Ratings and Resistance groups.

Variety	2015 Blackleg Rating Bare	2015 Blackleg Rating Jockey	Type	SECTION A - Resistance group of cultivar	SECTION B - Resistance group of previous year's cultivar (stubble)													
					A	B	C	D	AB	AD	AS	ABD	ABE	ABF	ABS	BF	BC	G	H
CONVENTIONAL VARIETIES																		
Hyola® 50	R		Hybrid	AD														
Brazzil	R-MR		Winter Graze 'n' Grain	BC														
Victory® V3002	R-MR	R	High stability oil, Hybrid	ABF														
Sensation	R-MR		Winter Graze 'n' Grain	B														
Nuseed Diamond®	R-MR		Hybrid	ABF														
AV-Zircon®	MR			A														
AV-Garnet®	MR-MS			A														

TABLE 1 - When considering Blackleg management strategies, using resistance varieties is vital. The GRDC has published a Spring Blackleg Management guide, an excerpt of which appears above. Full details and a downloadable guide can be found on the GRDC website via https://grdc.com.au/GRDC-FS-BlacklegManagementGuide

Overcoming disease management issues

Photo 2 - Sclerotinia in canola stubble. Photo: Phil Bowden.

Photo 3 - A canola seedling with symptoms of cotyledon infection with blackleg. Photo: Steve Marcroft, Marcroft Grains Pathology

Photo 4 - Canola stubble with fruiting structures of the blackleg fungus, these raised and black. Photo: Steve Marcroft, Marcroft Grains Pathology.

Discussion

Many of these fungal diseases have the potential to cause economic crop losses if care is not taken to select crop varieties that are resistant and grown in rotational sequences that reduce the inoculum levels over a number of seasons. Use of an integrated disease management strategy on farms uses a variety of options to keep disease pressure low.

The grains industry has invested in breeding programs that have addressed disease as the highest priority. New crop varieties suitable for different cropping systems are released each year, with agronomy packages that aim to give farmers the best economic result. This is the most cost effective way for farmers to keep on top of disease. New varieties with different genetic backgrounds can keep a step ahead of the disease, but diseases are constantly evolving and adapting to farming systems.

Crop rotations that include non-host plants will help keep the inoculum levels low.

Sowing varieties within the recommended sowing window for your district ensures that crop development occurs at the appropriate time to either avoid or withstand disease, and will ensure that plants remain vigorous and healthy and are better able to resist disease. Healthy plants can often outgrow the effects of disease and limit the potential for yield losses.

Use of foliar fungicides can give an economic return, but the timing of many of these needs to be exact so that the crop is protected at the appropriate growth stage when the disease inoculum is present.

Crop residues are a harbour of inoculum to infect newly emerged seedlings, and reducing stubble loads by mulching or burning can help with disease management, but this is not necessarily going to prevent infection. Farmers need to understand the specifics about each disease as each disease is different and will need to be managed separately.