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Canola Concepts :
Managing Blackleg

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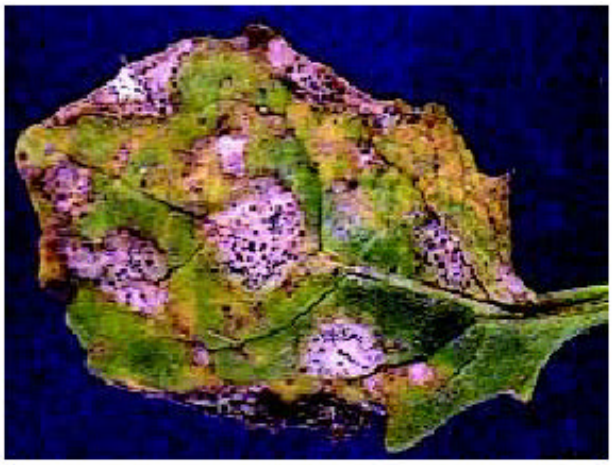
BLACKLEG: AN IMPORTANT CANOLA DISEASE.

This disease is still a major threat to the canola industry across Australia. The production area of canola in NSW has risen dramatically and consequently the incidence and severity of blackleg has increased steadily. Yield losses are significant and producers need to adopt management strategies to reduce production losses. Pathologists have measured yield losses in excess of 20% over a number of seasons. At current commodity prices ($380/tonne) a 20% reduction in yield could cost a producer $150 /ha based on an average 2 t/ha crop.

SYMPTOMS

Blackleg is caused by the fungus *Leptosphaeria maculans*. Leaves, stems, pods and roots of the canola plant can all be infected.



ABOVE: Light grey circular lesions form on the first leaves and contain numerous black spots (pycnidiospores).

BELOW: The fungus grows through the leaf and into the stem forming a constricting stem canker at ground level. Plants vary in their susceptibility to stem canker. Not all leaf infections lead to stem canker formation.

F Lewington 1999

BELOW: Badly cankered plants will break off at ground level and die. Less affected plants may survive but yields are reduced, often with lower oil levels.

F Lewington 1999

Cross section of a canola stem showing internal death (necrosis) of the lower stem.

The blackleg disease cycle (below) shows the importance of weather conditions during summer and autumn for the initiation of blackleg infections.

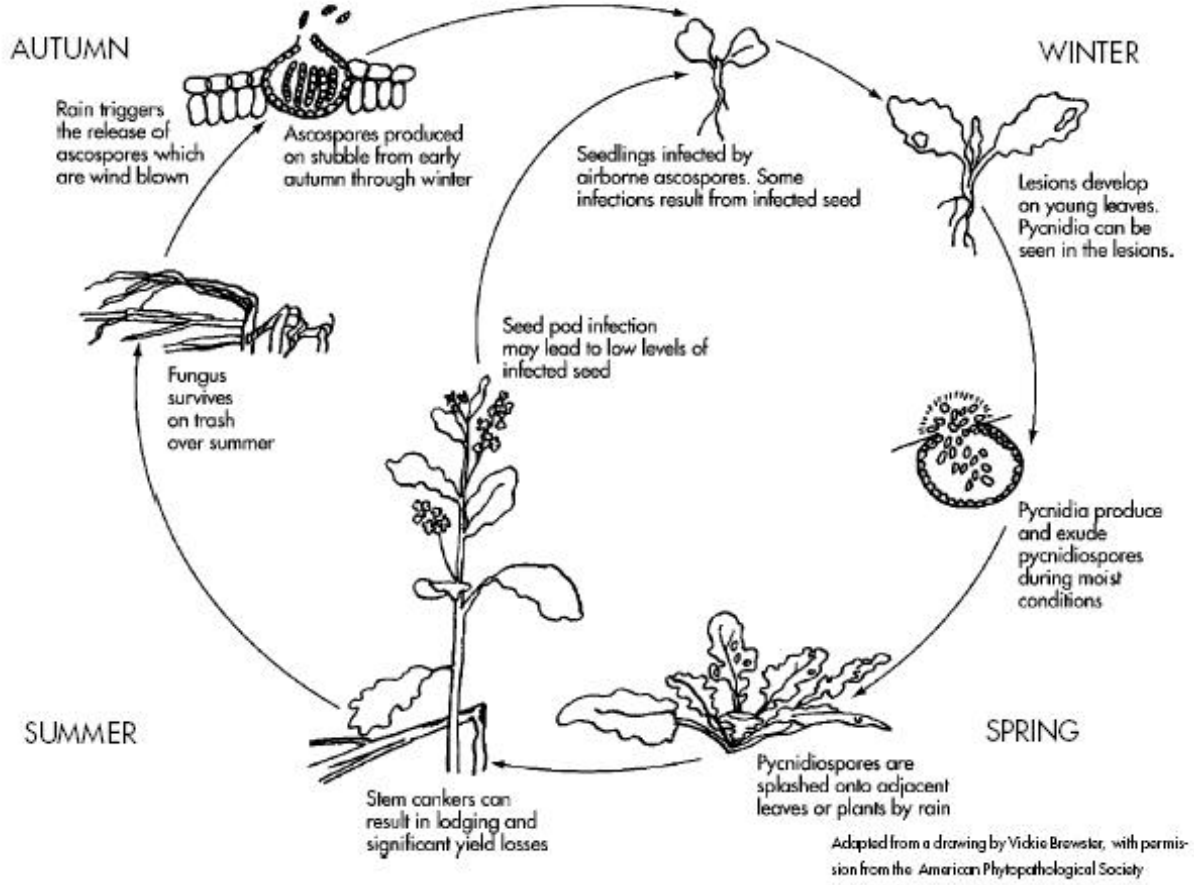
- Spore release can vary considerably between locations and between seasons as determined by rainfall and temperature.
- Canola seedlings of all varieties are susceptible to blackleg, until they achieve a degree of adult plant resistance, which usually occurs at about the six-leaf stage.
- Significant seedling losses can result from severe early infections. Infection at this time is critical to the development of severe stem cankers later in the season.
- Cankering may occur at any stage up to plant maturity and can result in high yield losses. These losses are not always obvious as even minor cankers can restrict the movement of water and nutrients up the plant stem.
- Internal rotting of the taproot causes plants to die before reaching maturity. Many plants die and lodge just before windrowing without any obvious stem canker. Affected plants often have black lateral roots, while taproots can have extensive internal tissue death (necrosis). Necrotic stem pith has been found in some plants despite them showing no external symptoms.

MANAGEMENT TOOLS FOR REDUCING BLACKLEG RISK

The 4 main tools that producers can use to reduce blackleg are:

- paddock selection
- stubble management
- varietal choice
- fungicides

Blackleg disease cycle



Adapted from a drawing by Vickie Brewster, with permission from the American Phytopathological Society

Paddock selection and Stubble management.

Previous blackleg recommendations focused on crop rotations and maintaining a three-year break between canola crops. This allowed the canola stubble time to decompose. Less canola stubble means fewer spores to produce blackleg infections.

However, paddock rotation and the number of years between canola crops are no longer considered to significantly affect blackleg levels- provided canola is not grown in a paddock two years in a row. How close the new canola crop is to the previous year's canola stubble has a greater impact on blackleg levels.

The widespread practice of growing canola next to the previous years' canola stubble poses blackleg management problems for canola growers. This is illustrated by a NSW Agriculture survey of canola paddocks during 1999 and 2000. More than 50% of canola paddocks surveyed were located beside a paddock which had grown canola in the previous year.

Both the age and volume of canola stubble present are important for disease severity. Research from Victoria headed by SJ Marcroft suggests 6-month-old canola stubble has the greatest impact on disease levels. These newest canola stubbles were found to release 98.6% of all blackleg spores and accounted for 80% of the volume of stubble present in the field.

Retained canola stubble poses the greatest disease threat and delaying its destruction until the following year is ineffective in reducing blackleg losses. The greatest spore releases from canola stubble occur in the first 6 to 10 months after harvest. The technique of burning canola stubble 16-18 months after harvest in conjunction with cereal residues has become common practice as more farmers have adopted canola, wheat, canola rotations. Given the information above, farmers need to re-evaluate when they burn canola residues. The survey carried out by NSW Agriculture in 1999 and 2000 found that less than 20 % of farmers in Southern NSW currently burn canola stubbles.

Destruction of new canola residues should commence as soon after harvest as possible to gain the greatest benefit. Victoria researchers found that raking/harrowing and then burning canola stubble was the most effective method for reducing canola trash levels. This was found to be 60% more effective than harrowing and working the paddock once before sowing. Turning off the header spinners at harvest can also facilitate a more effective burn by concentrating trash in rows.

Varietal Choice

Varietal choice is an important management tool that can minimise yield losses. Farmers currently have more than 30 canola varieties to choose from, with varying levels of blackleg resistance. Public and private breeding programs currently assign blackleg ratings to their varieties in accordance with the Canola Association of Australia independent national blackleg resistance rating system. Resistance is rated on a scale of 1-9 and indicates the relative differences in blackleg resistance between varieties. See table below.

Table 1. Blackleg Resistance Ratings

Highly resistant	8-9
Resistant	6-7.5
Moderately resistant	5-5.5
Moderately susceptible	3-4.5
Susceptible	<3

CAA, 2004

This resistance is only to stem cankers, as no varieties have resistance to leaf lesions at present. Farmers need to assess potential blackleg risks and choose varieties accordingly. A high-risk situation - such as a paddock neighbouring last years' canola stubble- will need special consideration. High spore loads put increased pressure on the resistance of a variety and significant yield losses can result if the chosen variety has inadequate blackleg resistance.

Varietal choice is a simple management tool that can reduce yield penalties associated with high-risk situations. Choosing a variety with a higher blackleg rating but with similar yield and oil characteristics as another variety can be effective in limiting blackleg losses. For instance, where a mid-maturing variety was to be sown in a high-risk situation, AV-Sapphire with a rating of 7 would be chosen in preference to Ripper, which is rated at 5.0. If a mid-maturing triazine tolerant variety was to be selected ATR Grace (6.5) could be chosen in preference to TI1 Pinnacle (5.0).

Breakdown of Blackleg Resistance

Several canola varieties incorporating a new source of blackleg resistance were released in 2000. This resistance was developed from *Brassica rapa* subspecies *sylvestris*, a wild relative of canola. It enabled plants to strongly withstand blackleg infection. Rated 9 under the CAA blackleg rating system the varieties Surpass 400, Surpass 501TT, Surpass 402CL, Surpass 404CL, Surpass 603CL, Hyola 43 and Hyola 60 were well accepted by growers due to this outstanding disease resistance.

However in 2002, cankered plants were identified in varieties with the *sylvestris* resistance. Blackleg was confirmed at three sites: Port Lincoln SA, Cudal NSW and Mt Barker WA. It was thought that a new virulent strain of blackleg had evolved that was capable of overcoming the *sylvestris* resistance genes.

In response to these findings, a wide scale survey of canola crops containing the *sylvestris* resistance was done in 2003. Disease levels were monitored across SA, NSW and Vic by a team of Victorian DPI and CSIRO researchers led by Steve Marcroft and Susan Sprague. They found 95 % of crops with the *sylvestris* resistance inspected in NSW, VIC and SA had plants affected by blackleg and the average number of plants infected per paddock was 38.5%. Crops in the Eyre Peninsula and Bordertown regions of SA were most affected suffering up to 90% yield losses.

The *sylvestris* resistance relies on a single dominant gene and a few minor genes. This provides the plant with almost complete immunity to blackleg infection and puts selection pressure on the fungus to overcome

the resistance. Consequently if the blackleg fungus is able to overcome this major gene and the plant has no back up level of resistance, it becomes susceptible to blackleg invasion.

The blackleg resistance in all other Australian canola varieties relies on a number of minor genes. This multi gene resistance is not complete and a certain level of blackleg infection generally occurs within a crop. Therefore, selection pressure on the fungus is low. The blackleg fungus may still be able to overcome these resistance genes however this would occur gradually.

Steve Marcroft, DPI Victoria, found that stubble from *sylvestris*-based varieties releases very low numbers of ascospores of "normal" blackleg compared to other varieties with multi gene resistance. This places pressure on the fungus to maintain its population: any strains within the blackleg fungus that can overcome the *sylvestris* resistance will be able to produce more ascospores and thus increase.

The strains responsible for the breakdown in blackleg resistance in varieties such as Hyola 60 have been identified. Melbourne University researchers have identified isolates that are able to overcome the *sylvestris* resistance in fungal collections made in the 1980's. With the expansion in the area sown to *sylvestris*-derived varieties these strain have increased in frequency. This means that such varieties are now susceptible to blackleg in areas where they have been widely grown.

An increased risk of crop failure exists if varieties with *sylvestris* resistance are grown in 2004. The canola varieties Surpass 400, Surpass 501TT, Surpass 402CL, Surpass 404CL Surpass 603CL Hyola 43 and Hyola 60 now have an approximate blackleg rating of 1 to 2. All other multi gene varieties are currently not affected by these strains and their blackleg ratings should remain unchanged for 2004.

Farmers should avoid planting varieties with *sylvestris* resistance particularly if these varieties have been grown in the area previously. If planting such varieties, producers should implement best management practice as outlined in this Agnote.

Fungicides

Producers now have expanded fungicide options available for minimising the impact of blackleg. Flutriafol (Impact-in-Furrow®, Jubilee®), a fertiliser applied fungicide, is registered for blackleg control. It has consistently given good control of all aspects of blackleg and given yield increases when blackleg has been severe. Fluquinconazole (Jockey®, Quantum®) and fludioxonil plus metalaxyl-m (Maxim XL®) are registered as seed dressings for suppression of blackleg. Carefully consider the cost benefit of applying these fungicides. Target those paddocks where disease pressure is high and/or where less resistant varieties are grown.

SUMMARY BLACKLEG MANAGEMENT TIPS

- Consider carefully where new canola crops will be planted to avoid planting beside last year's canola paddocks.
- Destroy canola residues as soon after harvest as possible by raking/harrowing and burning.
- Choose varieties carefully and plant those with the highest blackleg rating possible in high disease risk situations (where crop has to be planted beside previous years stubble)
- Consider using fungicides where blackleg has the potential to cause significant yield losses.

FURTHER INFORMATION

Winter Crop Variety Sowing Guide 2004

Canola Variety Guide 2004 Agnote

Canola Association of Australia 2004 Blackleg Resistance Ratings

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