Blackleg of rapeseed

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Blackleg of Rapeseed

Unless blackleg can be controlled there is little future for rapeseed as a major commercial crop in W.A.


Until 1972, oilseed rape showed great promise as an alternative cash crop for Western Australian farmers, especially in the Great Southern and south coastal areas where the annual rainfall ranges from 450 to 650 mm.

Good prices and market prospects brought an increase from about 120 hectares in 1969 to 49 000 ha in 1972, and it appeared that rapeseed could become an important crop for Western Australia.

However, like most other cruciferous crops, rape is prone to attack from diseases and insect pests. Most of these can be controlled, but the fungus disease black-

LIFE CYCLE OF THE BLACKLEG FUNGUS

AUTUMN

- wind blown ascospores
- production of perithecia and ascospores on trash from early autumn through winter
- ascospores
- asci (containing 8 ascospores) inside perithecium

WINTER

- primary infection
- seedling infection by ascospores
- seedling infection by pycnidiospores from pycnidia produced on seed coat
- production of lesions and pycnidia on young plant
- stem canker infection
- pycnidiospores released from pycnidium (Plenodomus stage)
- fungus survives on trash over summer
- stem canker infection to other parts of host or to new hosts
- water splash of pycnidiospores to other parts of host or to new hosts

SUMMER

- infected seed harvested and sown following season
- infected seed harvested and sown following season

SPRING

- seed pod infection
- stem canker infection to other parts of host or to new hosts
Blackleg lesion on the cotyledon

Two rape stems showing blackleg lesions on the crown

Blackleg lesions on the leaves

Blackleg lesion on the upper stem

Blackleg lesion on seed pod

Mildly infected rape crop with few plants lodging from blackleg disease

Fungal fruiting bodies (perithecia) on rape trash

Crop ruined by blackleg disease showing sparse stand and lodging plants
Leg (Leptosphaeria maculans) emerged as a major threat to the industry.

A serious outbreak of this disease in rape plantings in the Mt Barker area in 1971 was followed by a severe general epidemic in 1972. Many crops were devastated and yields drastically reduced in others. Infected stubble from previous crops enhanced disease development in nearby crops.

This disease situation resulted in a decline in rape plantings from 49,000 ha in 1972 to 3,200 ha in 1973 and 2,000 ha in 1974.

Clear, unless the disease can be controlled, there is little future for rapeseed as a major commercial crop in Western Australia.

The disease

Blackleg can affect other cruciferous crops, such as cabbage and cauliflower, and has been well known to local vegetable growers for many years. In agricultural areas the fungus has only been recorded on wild radish and rapeseed.

Both species of rape grown in Western Australia—Brassica napus and B. campestris—are susceptible to the disease. In the Northern Hemisphere these are grown as summer crops; in Western Australia they are sown from early July onwards and grow through the winter and early spring, taking about six months to reach maturity.

The mild, wet conditions during winter and early spring in this State are especially favourable for the development of blackleg.

The fungus exists as an imperfect state, Plenodomus lingam, which lives on the growing plant and produces asexual spores (pynidiospores) from black fruiting bodies called pycnidia, and as a perfect state Leptosphaeria maculans, which lives on dead crop residues and produces sexual spores (ascospores) from small black fruiting bodies (perithecia) on the stems of the dead plants.

In the imperfect state the fungus produces pycnidia in lesions on infected leaves, stems and pods. These release pynidiospores in a slimy mass, and these spores are spread by rain-splash in the growing crop. Seed infection can result from fungal threads (mycelium) growing through the pod and becoming established under the seed coat.

Symptoms

The fungus can infect any part of the plant.

The lesions are first seen on the seedlings as white or grey, circular spots on the cotyledons (seed leaves), and subsequently pycnidia develop in these. Less frequently, lesions appear on the stem as well.

Infected cotyledons die prematurely and the fungus may invade the stem by advancing through the petiole (leaf stalk). Pynidiospores produced on the cotyledons may later infect the crown (basal stem).

Lesions are more discrete on the true leaves than on the cotyledons. Leaf, stem and pod infection sites on older plants are surrounded with a dark purplish margin.

Attack of the flowering structure can cause blighting of the flowers. Pods which have fungal lesions usually produce infected seed, which is often shrivelled and may not germinate.

Invasion of the crown, which mostly results from cotyledon and leaf infection at the seedling stage, is the most damaging phase of the disease.

Badly affected plants are ring-barked at ground level by the cankers, and lodge. Less severely affected plants remain standing but have restricted sap flow; pods fail to fill and seed is pinched.

Although the fungus can be introduced into new production areas through infected seed this method of spread is not likely to cause a significant primary disease outbreak in the crop. An average of 0.1 per cent of infected seed has been detected in commercial seed lines.

If seed with this level of infection is the only source of inoculum the resulting disease incidence in the crop will be low. However, stems colonised by the fungus could constitute a disease risk for next season's crop planted in nearby areas.

Infected debris remaining after harvesting may be spread onto nearby clean paddocks by wind.

The fungus can survive on undecomposed crop residues for many years* and sowing onto old rape paddocks can result in severe losses.

Perithecia develop on infected crop residues left on the soil surface and may be found on plant fragments re-exposed by cultivation even after several years in the soil. Ascospores are released from these and blown on to neighbouring rape crops.

The first infection of the growing crop is usually from ascospores released from the previous year's stubble in autumn. The spores are forcibly discharged under moist conditions in the temperature range of 10 to 20°C and widely dispersed by wind to infect current crops. In 1972, isolation of 5 to 8 kilometres (3 to 5 miles) from previous years' stubbles was necessary for crops to be reasonably free of the disease.

Ascospore discharge from diseased 1972 stubble was measured with a spore trap. Spore levels were high in June, July and August.

<table>
<thead>
<tr>
<th>Month</th>
<th>Total no. of ascospores collected</th>
<th>No. of emission days</th>
<th>Average no. of ascospores per emission day</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>89,200</td>
<td>13</td>
<td>6,861</td>
</tr>
<tr>
<td>July</td>
<td>110,280</td>
<td>13</td>
<td>8,483</td>
</tr>
<tr>
<td>August</td>
<td>147,520</td>
<td>21</td>
<td>7,024</td>
</tr>
<tr>
<td>September</td>
<td>21,840</td>
<td>17</td>
<td>1,284</td>
</tr>
<tr>
<td>October</td>
<td>1,960</td>
<td>6</td>
<td>326</td>
</tr>
</tbody>
</table>

* The number of days per month on which spores were released.

Research in France has shown that heavy ascospore discharge during the early developmental stage of the rape plants (the cotyledon and one to two leaf stages), causes the general epidemic outbreaks of the disease in that country*. However, the primary lesions caused by ascospores appear identical to those produced by spores of the pycnidial state.

stage. Spores washed from leaf and stem lesions down into the soil may infect the base of the plant. Pycnidiospores exuded during moist periods cause secondary infection when spread by rain-splash.

Warm dry conditions hinder secondary disease build-up, whereas prolonged moist weather favours rapid spread and development of the disease.

**Variatel resistance**

Varieties now commercially available are all highly susceptible to blackleg infection. Tolerance to the disease is present in some rape selections developed overseas and plant breeders are now involved in incorporating this tolerance into commercial varieties.

**Control**

Destruction of crop residues after harvest will reduce carry-over of the fungus on infected stalk and basal stem-taproot pieces. Grazing the rape stubble and then root-raking rape debris into windrows and burning has proved successful in reducing fungus carry-over.

Leaving rape out of the rotation for as long as possible will allow the diseased residues to decompose and so reduce the risk of ascospore infection. At least three and even four years is the time necessary for this to occur.

Planting rape as far away as possible from previous rape crops will reduce the risk of infection by the wind-borne ascospores. This may not be possible to achieve if rape has been grown on neighbouring farms the previous year.

If planting is delayed, blackleg infection may be reduced if the weather conditions are unfavourable for fungal development. However, if planting is delayed too long both the yield and oil content of the seed will be reduced.

**Research**

Research is continuing on fungicidal treatment of seed and seedlings aimed at protecting the plants from primary infection by ascospores and secondary spread by pycnidiospores. Studies are continuing on the role of seed infection and on canker development. New varieties and selections are being screened for resistance to the disease.

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**NEW ENVIRONMENTAL AND CONSERVATION PUBLICATIONS**

Three publications which have appeared recently will interest those concerned with specific areas of the environment and its management. All are published by the Elsevier Scientific Publishing Company of Amsterdam and the first issue of each was in June 1974. Free sample copies of Vol. 1 No. 1 for each series are probably still available on request to the company at P.O. Box 211, Amsterdam, The Netherlands. Annual subscriptions range from $24 to $26.

*Landscape Planning* is described as an international journal on landscape ecology, reclamation and conservation, outdoor recreation and land-use management. In Vol. 1 No. 1 its editor discusses the need for work in this area and suggests that the journal will provide a medium for the exchange of ideas and the involvement of both environmental scientists and professional landscape planners.

He recognises that there is a need for teamwork between workers from several disciplines, under the leadership of a landscape architect, as a means of promoting sound landscape planning. In view of controversy in Western Australia over such things as the Kwinana industrial complex, Greenbushes tin and

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*Agro-Ecosystems* is an international journal sponsored by the International Association for Ecology. As such it is concerned with ecological interactions within and between agricultural and managed-forest systems and caters for reports of research into man-managed environments, including interactions between crops and grazing animals, natural wildlife vs domestic livestock, nutrient leaching into waterways, and so on. Vol. 1 No. 1 contains papers from authors in several countries and though more of a research reporting issue than *Landscape Planning* will provide a medium for those authors whose work lies between established journals and scientific fields.

*Agro-Ecosystems* will probably have less general appeal than *Landscape Planning* but nevertheless is likely to contain much that will interest those concerned with the environment.

*Agriculture and the Environment* is concerned with the balance between food production and environmental and biospherical management. On the one hand it will be concerned with the spatial relationship between agriculture and its environment, and on the other with the need to promote a balance between food production for populations and the need for responsible environmental management. It will be more directly related to agriculture than *Agro-Ecosystems* and Vol. 1 No. 1 contains a mixture of theoretical and research approaches to agricultural problems.

*Agriculture and the Environment* will appeal to many people concerned with the directions in which agriculture is moving, and with the effects of modern agricultural practices on the environment. Contributions in the inaugural issue come from several countries and cover such topics as using models to solve agricultural development problems, disease problems in intensive pig houses, soil pesticide residues and their uptake by crops, and the control of odour and pathogens arising from intensive poultry and livestock units.