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Breeding a barley resistant to leaf disease

By T.N. Khan, Plant Pathologist
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In the last few years the Department of Agriculture has begun a programme to produce barley varieties resistant to the leaf diseases, scald and net blotch. These diseases cause substantial losses that may not be apparent to an individual farmer.

The main diseases of barley in Western Australia are scald, *Rhynchosporium secalis*, and net blotch, *Drechslera teres*. Both these diseases can survive the Western Australian summer on dry stubble, whereas other diseases of barley such as mildew and rust require a live host to survive the summer and therefore are not an annual problem.

The extent of damage caused to barley by scald and net blotch has become apparent only in the last decade. Trials by the Department of Agriculture since 1962 have shown losses of up to 17 per cent from net blotch and 25 per cent from scald. Net blotch also reduces the quality of barley for malting.

The main effect of scald and net blotch is reduced seed size, so the loss in potential yield is not immediately apparent in a standing crop. However, although an individual farmer may not notice the effect, losses are widespread and therefore substantial on a State-wide basis.

Both diseases cause spots to develop on the leaves, but in the case of net blotch, these extend along the leaf to give a netted appearance. Scald eventually gives a "water-stained" appearance to the leaves.

Scald is particularly severe in southern, high rainfall areas and in medium rainfall areas of the Great Southern. It is less prevalent in lower rainfall areas as it requires the splash of raindrops to spread.

Net blotch is spread by wind and therefore rainfall has little effect on severity. However, humid weather is needed for infection.

Areas worst affected by net blotch are the northern and central wheatbelt where the warmer conditions encourage growth of the



A range of reactions of barley to net blotch. The spots enlarge to give a netted appearance in severe cases



Two barley varieties grown in pots, one with resistance to net blotch

disease. Since Clipper barley has been grown, damage from net blotch has been less severe as Clipper is resistant.

As both scald and net blotch can survive on stubble, they can be spread on dry trash over considerable distances by the wind. Western Australia's hot dry summers do not encourage the breakdown of trash, and it is therefore hard to control this spread.

To prevent scald and net blotch, potential control methods have

included treatment to disinfect seed, crop rotation, and stubble burning or heavy grazing of stubbles. However the spread of diseased trash by wind is hard to overcome and makes these precautions almost ineffective.

Another method of control, by fungicide, is unlikely to be effective in Western Australia because of its expense in relation to the comparatively low potential yields of Western Australian barley crops. The best way to control net blotch and scald is therefore by producing

resistant varieties. If resistant varieties can be produced, disease control would be simple and the resistant crops could take advantage of earlier planting.

However, breeding varieties resistant to net blotch and scald is complex. It firstly requires reliable methods of checking varieties for resistance, and hundreds of varieties then have to be checked for resistance as well as commercial yield.

The Department of Agriculture and the University of Western Australia are co-operating in a joint programme to develop disease resistant varieties suitable for commercial production. Suitable methods of checking varieties for resistance, have now been developed and these methods have been incorporated into the breeding programme.

To make the checks, the disease organism is isolated and cultured in laboratory conditions. From this culture, a solution is prepared with a suspension of disease spores, ready for spraying on the barley varieties.

In glasshouse tests, plants are covered with plastic bags for 48 hours to increase humidity after spraying on the solution. Humid conditions are also chosen for the field tests if possible. For large scale testing, barley trash from an infected plot is spread over the area.

In preparing the disease culture, care is necessary to ensure that all "races" of the disease are represented. Scald in particular has many races, each of which can infect different varieties. If a particular local race is not included in the disease culture, varieties selected as being resistant may succumb to infection by the local race when they are released.

When a disease has many races, there is always the risk that a new race will develop and be able to infect the currently grown variety. Therefore to rely on resistant varieties to prevent outbreaks, new resistant varieties must be constantly released. For example this is necessary with wheat varieties



Two barley varieties grown in pots, one with resistance to scald



Scald susceptible barley growing next to a resistant type. Symptoms could be easily overlooked without a resistant variety for comparison.

resistant lines are being yield tested in the Department's plant breeding and variety trials.

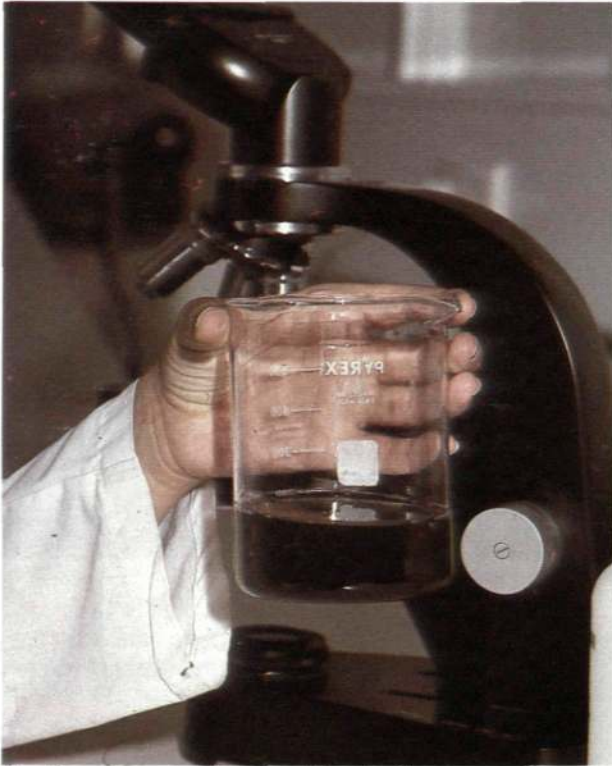
Testing barley plants for resistance to leaf disease — see over

resistant to rust.

Once a barley variety resistant to net blotch and scald is found, crossbreeding is used to produce new varieties with both resistance and commercially satisfactory yields. These crossbreds are tested as part of the Department's normal programme for improving barley varieties.

Already scald and net blotch

Testing barley plants for resistance to leaf disease



The disease organism is cultured in the laboratory under controlled conditions and a suspension of disease spores is prepared for spraying on to plants



Spore concentration is then counted under the microscope to ensure that an equal amount of spores is deposited on each plant to be tested



The suspension of disease spores is sprayed on the plant



Plants are finally covered with a wet plastic bag to raise the humidity for 48 hours. This allows the disease spores to germinate and if the plant is susceptible, to start an infection