

## TAKE-ALL MANAGEMENT

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### Background information

Take-all is caused by *Gaeumannomyces graminis*, a fungus which attacks the roots of susceptible grasses and cereals reducing their ability to take up water and nutrients. This results in lost production in cereal crops and in severe infections, the production of empty heads commonly referred to as 'dead heads' or 'white heads'. Thus the name Take-all or hay-die.

### Importance

Take-all is the most serious cereal root disease in southern Australia with estimated losses of \$100 - 200 million per year. Yield losses from Take-all can occur in most soil types but the greatest losses occur in sandy alkaline soils.

When Take-all is severe and nutrition is poor, farmers can experience total crop loss. This is not common with current fertiliser strategies and where legumes are included in the rotation. The losses from Take-all are probably higher than many people realise as 20-30% yield loss can occur without any visible above ground symptoms such as 'dead heads'.

### Hosts

All the cereals (except for oats), barley grass, brome grass and silver grass will host the disease and allow it to build up for the following season. There is an oat attacking strain of Take-all but, so far, it is important only in oat-growing districts of Western Australia. Ryegrass is regarded as a poor host in most situations, however exceptions have been identified. Further advice should be obtained from your local adviser.

The cereals differ in their ability to withstand the damage caused by the disease in the root system. Wheat and triticale are the most susceptible to Take-all, followed by barley and then cereal rye and oats, which are both tolerant. Yield losses with barley are about half that of wheat for the same level of Take-all fungus in the soil.

There are no consistent differences in the susceptibility of different varieties of wheat and barley to Take-all. There are differences between triticale varieties, however, the susceptibility of the current commercial varieties is not clear. Tahara appears to be as susceptible as wheat.

### *Life cycle*

The fungus infects the roots of susceptible grasses and cereals soon after their germination. During the growing season the fungus spreads along the roots blocking the movement of water and nutrients to the tops. When the soil is moist, the fungus spreads to the base of the stem (crown) and causes major yield losses.

The fungus survives over the summer in the root and crown remains of host plants.

### *Factors affecting survival of the fungus*

Take-all survival is favoured by dry conditions when it is living on the remains of host plants over summer and early autumn, and by wet conditions when attacking a host plant during winter and spring.

Summer and autumn rains can reduce the levels of disease in the plant remains as the Take-all fungus does not compete well with other soil organisms. Self-sown cereals or other volunteer host plants that germinate in response to summer rains are not usually infected by Take-all as the soil temperatures are too high for infection to take place. As soil temperatures drop in autumn, these host plants are attacked by the fungus and become an important source of infection for newly sown crops.

Survival of the fungus is favoured by the stubble remaining close to the surface where it is more likely to remain dry. Burying stubble usually reduces Take-all survival because the soil remains moist for longer which exposes the fungus to competition from other soil organisms.

An early break to the season and good volunteer grass control can reduce fungus levels prior to cropping.

During the growing season the same conditions that favour the spread of the disease on the roots of susceptible crops (ie. average to above average rainfall) also favour the survival and carry-over of disease. Therefore, Take-all levels increase following wet years and decline following dry years. Following two dry years, Take-all levels will usually be very low. Early sowing encourages greater build-up of disease for the following year.

### *Factors affecting yield loss*

Significant yield losses from Take-all only occur when:

1. there is sufficient fungus present for early root infection
2. adequate rainfall which allows disease development.

When these two conditions are met, yield losses are highest. If these conditions are followed by a period of high moisture stress after flowering, the characteristic 'wheat heads' or 'dead heads' form.

It is important to note that yield losses 20 - 30% due to Take-all can occur without any visible plant top symptoms such as 'dead heads'.

The amount of Take-all fungus in the soil can vary between seasons even when there is a suitable host each year. Results from a trial at Avon, SA, over an eight year period has shown that the loss due to Take-all in wheat following a grassy pasture averaged 30% (0.6 t/ha) but losses in individual years ranged from 0 to 60%.

*Not all 'dead heads' are caused by Take-all*

The appearance of 'dead heads' in crops does not necessarily mean that there is Take-all. Other possible causes for 'dead heads' include mice damage, cutworms (caterpillars that gnaw at the base of the stem) and crown rot caused by a *Fusarium* fungus.

Crown rot infects cereals (wheat, barley, triticale) and most grasses. The fungus can be identified by a honey coloured discolouration at the stem base which may be accompanied by pink growth and the loss of single tillers in the early stages of the disease. A Take-all infected plant will usually have all tillers affected at the same time.

### Control Strategies

To reduce the potential losses from Take-all, farmers need to reduce the amount of the Take-all fungus in the soil or sow crops that will not suffer significant yield losses. Levels of Take-all in the soil can be determined from soil tests and is named a Bio-assay for Take-all. Rural Bio-assay Services provide the service for \$40 (contact 08/280 7163).

#### Short term

If growing a susceptible crop in a paddock with a Take-all bioassay rating of 1 or above then the following disease reduction strategies need to be considered. None of these strategies is entirely satisfactory as only limited control will be achieved. They are suggested for consideration in situations where there are no other feasible options for growing non-host crops or pastures.

*.... control grasses and self-sown cereals prior to sowing*

Volunteer grasses and cereals should be removed using cultivation or chemical application within three weeks of germination to prevent the build-up of Take-all (and *Rhizoctonia*).

*.... sow paddocks with a high Take-all rating last*

The amount of Take-all declines in moist soil following the opening rains when grasses are controlled. Crops sown later will therefore have less disease. Any

potential yield benefit from early sowing is not realised in diseased paddocks. The strategy is to identify and sow clean paddocks first and any suspect paddocks last.

*.... sow tolerant crops in paddocks with low to moderate levels of Take-all*

Cereals that are most tolerant of Take-all, such as barley, will suffer less yield loss than wheat or triticale when disease levels are low to moderate. However, tolerant varieties are similar to wheat in that they will carry over the disease to the following season. When disease levels are high, barley can yield as poorly as wheat.

*.... cultivate in moist conditions to promote Take-all reduction*

Cultivation when the soil is moist can reduce the level of Take-all fungus in the soil if the infected plant remains stay buried. Tillage procedures that bring the plant remains to the surface (ie. prickle chain, blade plough) can reduce breakdown of the Take-all fungus. In seasons favourable to the build up of Take-all this can result in increased yield losses in susceptible crops.

*.... burn stubbles if sowing a susceptible crop after a bad Take-all year*

Burning stubbles can reduce the level of disease if a significant proportion of it is in the stem base. The stem base is likely to be infected if there was severe Take-all the previous year. The fungus on the roots below ground will not be reduced by burning. To achieve control of Take-all a 'hot' burn is required that destroys most of the stubble. This option is not recommended and needs to be considered in relation to the benefits of stubble retention.

### Long-term strategies

When Take-all bioassay rating are 2 or 3 the safest option is to use non-host crops or pastures. If the crops and pastures are kept grass free then Take-all will be greatly reduced for the following year.

*.... reduce Take-all in following years by using non-host crops*

Rotation with non-host crops (grain legumes, oilseeds, oats - in south eastern states) is the most common form of Take-all control. One year of non-host crop will give effective disease control provided that grasses and volunteer cereals are removed.

*.... clean legume pastures are an alternative to using non-host crops*

Rotation with non-host pastures such as medic, clover and lucerne can also be effective if host grasses and cereals are removed early enough in the season. If legume pastures are kept free of grasses, they are similar to non-host crops. To reduce Take-all, host grasses such as barley grass and brome grass must be controlled early in winter.

Chemical removal of grasses from pastures can give effective control of Take-all and is particularly useful in low rainfall environments where alternative crops are limited. The timing of herbicide application is critical with maximum disease control occurring with herbicide applications in mid to late June. Herbicide applications by mid to late July will have only marginal effects on reducing disease, except in higher rainfall districts (greater than 450 mm) where these application times are still effective.

The above recommendations for timing of herbicide applications are suitable for early and normal 'breaks' to the season. Late 'breaks' make the use of grass removal techniques more difficult as a one month delay in the 'break' may only result in a one week delay in the herbicide application date for effective disease control. Following late 'breaks' it would be advisable to apply the herbicides as soon as practicable. Results have shown benefits from disease control from early August application dates following a 'break' in late June.

As a rule of thumb, a grass density of 100 plants per square metre of a major host such as barley grass and brome grass is the maximum allowable level to limit disease build-up. Disease build-up is greatest at densities of 300 or more plants per square metre.

### What does your Take-all\* bioassay result mean

#### Important note:

The yield loss figures below are presented as a guide. The actual loss from Take-all will vary depending on the rainfall during the growing season. The estimates of yield losses are for susceptible crops such as wheat and are based on data from trials at Avon, SA which has a typical Mallee soil and rainfall.

# 0

All test plant roots free of Take-all lesions.  
Little to no Take-all fungus present in the soil samples.

% yield loss	Dry season	0
	Average season	0
	Wet season	0

**Options** All crops can be considered

# 1

Less than 30% of test plants infected.  
The Take-all fungus is present in the soil samples at a low level

% yield loss	Dry season	0
	Average season	10
	Wet season	20

**Options** Consider short term control options when sowing susceptible cereals

**2**

Greater than 30% and less than 50% of the test plants infected.  
The Take-all fungus is present in the soil samples at a moderate level.

% yield loss	Dry season	10
	Average season	20
	Wet season	30

**Options** Consider non-host crops and grass free pastures  
Implement short term control options when sowing susceptible cereals

**3**

Fifty percent or more of the test plants infected.  
The Take-all fungus is present in the soil samples at a high level.

% yield loss	Dry season	20
	Average season	50
	Wet season	70

**Options** Non-host crops and grass free pastures are the best options  
Implement short term control options when sowing susceptible cereals

*See Background Information for more details on control options*

\* 'Take-all' and 'Hay-die' are the same

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**REMEMBER: BCDS Field Day - 14 September**