FS 250 Revised September 1983

Combating Take-All Root Rot of Winter Wheat in Western Oregon

Take-all root rot of wheat *(Gaeumannomyces graminis* var. *tritici)* has increased in western Oregon with the increased frequency of wheat in rotations. Take-all produces a black, infected root system and lower stem; plants may be stunted and yellow, and may produce white heads with few kernels. Effective fungicide treatments are not available, and there are no varieties with effective disease resistance.

Oregon State University research has shown that *careful management can reduce damage and crop loss* from take-all.

Factors That Increase Disease Severity

★ Planting wheat following wheat or following crops that are hosts for the take-all fungus and/or make the soil conducive for attack of wheat roots by the fungus.

★ Early planting favors early infection and establishment of the fungus on the root system, and lengthens the period of time favorable for attack.

★ Any nutritional or environmental stress, especially during seedling or early tillering growth stages.

★ Soil pH values of 5.8 and higher.

★ Liming moderately acid soils (pH 5.4 to 5.6) has increased take-all. However, on severely acid soils (pH less than 5.4), aluminum and manganese toxicity and decreased P uptake reduce vigor of wheat roots and plants. This reduced development of new roots increases severity of take-all attacks.

★ Wet soils, especially in the spring, favor fungus spread throughout the root system.

★ Uptake of nitrate-nitrogen (NO_3-N) by wheat plants, especially in the fall.

★ Leaving infected crowns and roots in the seedbed at planting time.

★ Mild winters and cool springs.

Factors That Decrease Disease Severity

★ Planting wheat following crops that *are not* hosts for take-all fungus and/or make soils suppressive for attack by the wheat take-all fungus.

★ Soil pH values of 5.4 to 5.6.

★ Late planting delays the initial establishment on the root system and shortens the time favorable for attack.

★ Chopping stubble followed by deep plowing (10 to 11 inches deep) to reduce inoculum in the surface 6 inches of soil. This should delay and reduce severity of seedling attack.

★ Uptake of ammonium (NH_4-N) by wheat plants.

★ Banding phosphate (P) fertilizer with the seed increases root growth and vigor in wet-cool soils. Late planting accentuates low soil temperature problems.

★ Banding chloride (Cl) fertilizers plus NH_4-N with or near the seed at planting.

★ Spring application of chloride (Cl) fertilizers reduces stress on the host from take-all.

★ Dry soil conditions both in the fall and spring.

★ Cold winter temperatures followed by warm spring temperatures.

Assessing Potential for Take-All

High risk of take-all:

- Wheat after wheat with take-all root rot evident (white heads, infected roots) in the previous crop.
- Second and third consecutive wheat crop following a wheat-row crop rotation.
- Second and third consecutive wheat crop after legumes with quackgrass problems.
- Wheat following quackgrass, brome grass, bentgrass, or other grasses that host the fungus and make the soil conducive to take-all. (Barley acts like wheat in crop rotation sequences.)

Moderate risk of take-all:

- Second consecutive wheat crop following a clean legume seed crop. The risk is greater following red clover, where grass was present in clover and where wheat has been produced 4 or more years in the last 8.
- Second consecutive wheat crop following ryegrass where quackgrass or other grasses conducive to take-all were not present.

Low risk of take-all:

- Wheat following oats in a wheat-oats rotation.
- Wheat following a row crop.
- Wheat following a *clean* summer fallow.
- Wheat following clean ryegrass or orchardgrass if wheat or barley have not been produced in recent years.
- Wheat following oilseed crops.
- Wheat following wheat where take-all decline (TAD) has been established. This usually takes 4 or more years of

OREGON STATE UNIVERSITY EXTENSION SERVICE

Extension Service, Oregon State University, O.E. Smith, acting director. Produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Extension invites participation in its programs and offers them equally to all people.

continuous wheat. TAD is a biological system that suppresses the activity of the take-all fungus. *Many factors affect TAD. Experience on individual farms is important in predicting TAD.*

Planting and Tillage Recommendations

★ Plant after October 15. *Late planting reduces the risk of crop loss for all wheat diseases in western Oregon.*

However, late planting followed by heavy rains increases water damage during the 2- to 4-leaf growth stage. There is also a possibility of being rained out with late planting.

Planting sequence for different fields:

1. First year wheat on poorly drained soils with low take-all risk. *Plant first.*
2. First year wheat on well-drained soils with low take-all risk.
3. Two or more wheat crops on soils with restricted drainage.
4. Wheat following a row crop.
5. Continuous wheat on well drained soils where disease severity has been reduced by establishment of the take-all decline (TAD) phenomena.
6. Second, third, or fourth wheat crop on well drained soils. High risk take-all crop sequences. *Plant last.*

Tillage programs to follow:

★ Wheat following wheat, oats, barley, or ryegrass— flail chop stubble after harvest, disc to mix some soil with straw, plow just before planting. *Moisture from fall rains drains into the subsoil on unplowed fields and reduces the risk of late plowing and planting.*

★ Plow 9 to 10 inches deep at top speed for your plow to achieve maximum cover of infected crown roots from last year's wheat or barley crop. Infected stubble left in the seedbed increases take-all.

★ **Planting on ridges plus surface leveling to reduce water accumulation around the crown of plants will reduce adverse effects of water. Do not make ridges on hill soils.**

Fertilizer Recommendations

N fertilizer before discing straw

★ *This is a change in suggested recommendations*—where wheat follows wheat, barley, oats, or grass seed with 2 tons or more of straw per acre to plow down, adding N will increase stubble decomposition and make it easier to plow.

- Apply about 30 lbs N per acre on the stubble immediately before discing. A fertilizer solution that wets the stubble may be preferable. Eliminate this application if soil tests show 30 lbs nitrate-N in the plow layer.

Fertilizing at planting

★ *Band fertilizer with the seed at planting.* Seedbed soil moisture is generally adequate by October 15 to minimize salt damage when banding fertilizer with the seed. With normal Willamette Valley soil moisture and temperatures for October, band fertilizer with seed as follows:

- 20 to 30 lbs ammonium (NH_4-N) per acre
- 40 to 50 lbs phosphate (P_2O_5) per acre
- 35 to 40 lbs of chloride (Cl) per acre
- 8 to 10+ lbs of sulfur (S) per acre—followed by 15 to 20 lbs S per acre about March 1.
- 30 to 40 lbs of potash (K_2O) per acre as potassium chloride *where soil tests indicate* K needed and to supply chloride.

Specific materials to apply:

Alternative No. 1

- 60 lbs of ammonium chloride per acre
- 30 lbs of ammonium sulfate per acre
- 80 lbs of monoammonium phosphate (11-48-0, 11-52-0, or 11-55-0) per acre

Alternative No. 2

- 60 lbs of ammonium chloride per acre
- 25 lbs of ammonium sulfate per acre
- 100 lbs of conc. superphosphate per acre

Alternative No. 3

- 150 lbs ammonium phosphate-sulfate (16-20-0) per acre
- 75 lbs potassium chloride per acre

Alternative No. 4

- Mixed fertilizer like 10-20-20 or 10-20-22 to supply 20 lbs of N, 40 lbs P_2O_5, 40 lbs K_2O as potassium chloride.

Alternatives No. 1 and No. 2 give less salt effect per pound of N and Cl applied.

- *Banding any fertilizer salt with the seed at planting time can delay emergence and reduce stands.* Low soil moisture, fertilizer salt index, high temperatures, sandy soils, and high rates of fertilizer application will increase the risk of delayed emergence and stand reduction.
- *Do not band* urea, diammonium phosphate, or ammonium nitrate in mixtures with the seed at planting.
- Including nitrification inhibitors with fall-applied ammonium-nitrogen (NH_4-N) may be beneficial.

Spring Application of Nitrogen and Chloride

★ Where wheat follows wheat or barley with a heavy crop of stubble plowed down and is in the 4 to 5 leaf stage of growth Feb. 10 to 15. Apply 30 to 50 lbs nitrogen per acre plus 75 to 125 lbs chloride per acre between Feb. 15 and Feb. 28. Apply an added 80 to 90 lbs nitrogen per acre in mid- to late March but before growth increases so that wheeled vehicle traffic will not permanently damage stalks of wheat.

Reduce this rate of N on shallow soils that have 80- to 90-bu yield potential.

★ Where tillering has developed by February 15, make one spring application of nitrogen and chloride between March 1 and 15.

★ Combinations of fertilizers, herbicides, and fungicides will reduce application costs.

Chloride can be supplied by:

- Ammonium chloride—66% Cl.
- Potassium chloride—47% Cl.
- If available, calcium chloride—65% Cl or magnesium chloride—74% Cl.

Prepared by T. L. Jackson, R. L. Powelson, and N. W. Christensen. Jackson is Extension soils specialist and professor of soil science, Powelson is professor of plant pathology, and Christensen is associate professor of soil science, Oregon State University.

Note: Where take-all is *not* expected, follow OSU *Fertilizer Guide* 9.