TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE Portland, Oregon SOIL CONSERVATION SERVICE

AGRONOMY No. 15 July 1984

CEPHALOSPORIUM STRIPE OF WINTER WHEAT AND WINTER BARLEY

Description

Cephalosporium Stripe "Cephalosporium gramineum", is a fungus that attacks winter wheat and winter barley. It causes distinct yellow stripes on the leaf blades, sheaths and stems. Infected plants are usually dwarfed and dark discolorations may develop below the nodes. Heads are white, have shriveled kernels and flared awns. Yield losses result from reduced head size, head sterility, reduced seed set, and shriveled kernels. Heavily infected fields will have less straw.

It is common in fields with repeated growth of susceptible cereal or grass crops, in cutover timber lands, in low wet areas, and on soils low in nitrogen. All winter wheat fields have some fungus spores. The amount of inoculum present determines the potential for infestation.

Several grasses (Bromus, Dactylis, Poa spp.) are susceptible, but winter wheat is the major economic host. Spring grains and annual grasses are also susceptible, but seem to escape infection or avoid injury as they are not subject to freeze damage and root breakage.

Symptoms

Diseased plants are randomly distributed and occur more in lower, wetter areas of a field. During jointing and heading, showy chlorotic, longitudinal stripes appear on leaves. The stripes eventually show a decay or death of cellular tissue which is most prominent on younger green leaves. The continuity of stripes, and one or more darkened veins within them, through the culm, leaf sheath and blade is a sign or symptom of the infection. Normally, only one or two (rarely more than three) stripes and discolored veins are present per leaf. Stripes may not develop on all tillers of diseased plants.

Near harvest, darkening of the culm at and below nodes may occur. Plants so affected are stunted, prematurely ripe, and white-headed. These quickly become colonized by mold fungi and turn black in color.

Life Cycle

Cephalosporium stripe is a soil-borne fungal disease. It is the only fungal pathogen of wheat that grows in the plant's vascular system.

The fungus survives from year to year in infected host residue (straw and roots) on the soil surface or in the upper three inches of soil. The fungi sporulates in November. It moves with water to new roots where it enters the new wheat plant primarily through broken roots created by freezing and thawing and spring heaving of the soil surface. There is also evidence that it can enter through frozen roots or into roots broken by spring tillage of wheat such as shanking in fertilizer. A wet - cool winter with freeze/thaw

cycles is necessary for the spores to attack new plants. After entering the plant, the fungus spores infect the food and water conducting tissues of the stems and leaves. Water and nutrient movement from the root to the rest of the plant is impeded by the fungus attacking and destroying the vascular conducting tissues.

Fungus remaining on the residue of the host plant is available to infect the subsequent crop (winter wheat). It can survive on infected residue for two to three years.

Build up of the fungus occurs as a field by field situation. These must be a combination of (a) growing host crop, (b) history of plants with Cephalosporium Stripe, (c) infected crop residue left at or near the surface, and (d) a freeze/thaw situation that allows the spores to enter new host plants.

Control

Control comes from removing the host plant for two to three years from the rotation, reducing soil-borne inoculum and/or reducing the incidence of root damage. Cephalosporium stripe cannot be controlled by use of any known fungicides. The amount and type of controls applied will depend upon the amount of inoculum present in a field. Positive identification of the disease should be made before treatment is started. Burial and/or burning will not get rid of stem rust and other similar diseases and will result in excessive erosion.

Reducing soil-borne inoculum:

1. Planting nonhost crops such as 2-3-year spring grains, corn or legumes will reduce the fungi to a tolerable level. It is important that grasses (Bromus, Dactylis, and Poa, spp) be eliminated by chemicals or cultivation to prevent them from acting as host plants. This type of rotation should be our first suggested alternative for irrigated cropland or in areas where annual cropping or growing spring grains can be carried out successfully.

2. Grow cultivars which have shown more tolerance to Cephalosporium stripe. Daws, Nugaines, and Hill 81 have shown acceptable levels of resistance or tolerance to this disease (see Table 2). Note - During the 1983-84 winter Stephens wheat was severely damaged by frost. Many fields had 50 percent of the existing tillers aborted after winter frosts. Many of these fields were also heavily infected with Cephalosporium stripe.

3. Cut and remove stubble - followed by burial of the crowns and roots deep enough so they are not in the three inch root zone of new plants.

4. Break the life cycle by burial of the infected residue. In fields where erosion will be a problem, leave the stubble standing during the first winter. The straw should be buried deep enough so it will be below three inches at seeding time.

Cultivation that leaves highly infected residue on the soil surface or in the upper three inches of soil at planting time will not break the life cycle.

This alternative and the following one should only be recommended when a field has been identified as having a high incidence of cephalosporium stripe and other treatments, such as a rotation change, are not practical.

5. Burning of stubble in severely diseased fields. This only helps in reducing the amount of residue that must be buried. Crowns of host plants (winter wheat) and the straw up to the first node are the most infected part of the plant. Burning seldom destroys this part of the residue which will have sufficient amount of inoculum left on it to infect the next crop of winter wheat (see Table 1). Therefore, the crowns must still be buried below four inches to remove the fungus spores from the three inch root zone where infection takes place. CAUTION: Burning reduces soil moisture intake rates and will result in excessive runoff and erosion on sloping lands.

In fields where erosion will clearly be a problem, delay burning until spring. Erosive fallow fields should then be tilled as little as possible then seeded cross slope and left in a rough condition through the winter.

6. Chemical Fallow - Burial - another treatment for erosive fields would be to use chemical fallow. Then either plant spring barley after the second winter or the residue could be destroyed by burial just before seeding of winter wheat.

Long term control can best be achieved by (1) using rotations with one out of three years in winter wheat or winter barley, (2) growing more resistant varieties, (3) delayed seedings, and (4) control of host grass plants (weeds).

Reducing Root Damage

1. Increasing soil tilth, intake rates and permeability will allow winter moisture to penetrate deeper and faster into soil profiles. This will (a) help reduce surface moisture, (b) reduce frost, and (c) reduce breakage of roots. Soils should be checked for plow soles, compaction, or straw layers and chiseled or subsoiled as needed. Reduced till or no-till needs to be closely checked to see if the resulting soil improvement assists in resisting leaf stripe. No-till drills should not place any of the infected residue in the row with the seed.

Nitrogen fertilizer needs to be applied to fall seedings. Preferably placed below the seed 1½ - 2 inches. Avoid shanking in fertilizer in the spring on growing fall wheat.

2. Seed late in the fall on fields with a history of stripe rust, using no phosphate fertilizer. This will limit autumn root growth and minimize sites for injury and infection. This alternative should only be used as a last resort on highly erosive fields.

3. Surface drainage of low wet areas may also help to reduce the incidence of leaf stripe.

TABLE #1

Test Plots for Cephalosporium Stripe

1984 Comparison of Amounts of Inoculum on McDermid Winter Wheat

100% Infected Chopped Straw Applied to Plot (lbs per acre)	% Infection of Cephalosporium Stripe
0 (check plot)	26
16	55
32	64
64	65
128	81
256	80
512	89
1024	89

From work completed by Dr. William Bruehl, Plant Pathologist, WSU. A very susceptible wheat (McDermid) was used. The tests were completed on the Palouse erosion farm on Palouse silt loam soils on a south slope. The rotation was: 1981 - winter wheat; 1982 - peas; 1983 - fallow; 1984 McDermid winter wheat. 1983-1984 was an unusually favorable winter for growth of Cephalosporium. Note that even the check plot had 26% stripe.

Table #2

Cephalosporium Stripe

1984 Comparison of Varities

Washington State University

Variety	Yield on Check Plot Bushels/AC	Yield With Very High Inoculum Added Bushels/AC
Nugaines	91	31
Daws	86	30
Luke	79	41
McDermid	79	18
Lewjain	74	52
Stephens	69	14
Hyslop	62	17

Information from Dr. William Bruehl, Plant Pathologist, WSU. The plots were sprayed with Bayleton to control rust and Benylate to control foot rot. Reduction in yield was from Cephalosporium Stripe infection.

TABLE #3

AGRONOMIC CHARACTERISTICS GUIDE
WINTER WHEAT

Jerry Brog
Umatilla County Extension Agent

August, 1983

	COMMON SOFT WHITE WINTER WHEAT*						CLUB TYPE WINTER WHEAT#			
VARIETY	HILL 81	STEPHENS	HYSLOP	NUGAINES	DAWS	LEWJAIN	FARO	TYEE	CREW	JACKAR
HEIGHT	Semi-Dwarf	Semi-Dwarf	Semi-Dwarf	Semi-Dwarf	Semi-Dwarf	Semi-Dwarf	Semi-Dwarf	Semi Dwarf	Semi-Dwarf	Semi-Dwarf
STRAW STRENGTH INDEX	8	8	8	8	8	7	7	7	6	7
EMERGENCE INDEX	8	5	7	5	4	6	6	5	6	5
WINTER HARDINESS INDEX	8	3	4	6	8	5	5	5	5	7
MATURITY	Mid-season	Early mid-season	Mid-season	Mid-season	Mid-season	Late	Mid-season	Mid-season	Mid season	Mid-season
TEST WT. INDEX	8	7	7	9	7	7	5	5	6	5
YIELD (1978-82 AV.[1]) BU./ACRE										
PENDLETON	71.3	77.5	73.1	72.2	72.9		71.5	75.1		
HOLDMAN	47.4	50.9	46.8	48.5	49.8		48.3	53.7		
WESTON	65.8	72.4	67.3	68.2	68.6		62.3	64.8		
PILOT ROCK	37.8	40.1	38.9	36.3	38.2		35.7	39.6		
ECHO	31.4	31.2	29.0	28.9	29.0		32.9	28.7		
IRRIGATED YIELD[1] (1978-82 AV.)						Not enough data to compare			Not enough data to compare	Not enough data to compare
PENDLETON	75.7	80.6	79.0	65.8	72.8		No data	No data		
HERMISTON	76.6	76.9	77.0	63.2	77.2		No data	No data		
DISEASE RESISTANCE[2]										
COMMON BUNT	R	R	R	R	R	R	R	MR	MR	R
DWARF BUNT	S	S	S	S	S	R	S	S	S	-
LEAF RUST	R	S	MR	S	MS	MS	S	S	MS	S
STRIPE RUST	MR	R	MR	MR	MR	R	R[3]	R[3]	MR	R[3]
FLAG SMUT	S	MS	S	MR	MS	S	MS	S	MS	MS
CEPHALOSPORIUM STRIPE	MR	S	S	MR	MS	MR	MR	MR	MR	MR

1 1983 Columbia Basin Agricultural Research Report #680
2 S - Susceptible; MS - Moderately Susceptible; MR - Moderately Resistant; R - Resistant
3 Susceptibility to a new race reported in 1983 in these varieties

* Reviewed by Dr. Warren Kronstad
Plant Breeder, Oregon State University

\# Reviewed by Dr. Chuck Rohde, Wheat Breeder
Columbia Basin Agricultural Research Center

References

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Unpublished data from Dr. William Bruehl, Plant Pathologist, University of Washington, 1984.

"Cephalosporium Stripe" July 1984, by R.S. Korow, Extension Cereals Specialist, R. L. Powelson, Cereals Plant Pathologist, and P.A. Koepsell, Extension Plant Pathologist, OSU.