NCR-184 Management of Fusarium Head Blight of Small Grains Minnesota State Report – 1999

by
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In 1999 Minnesota spring wheat production was estimated at 2.2 million acres, up 250,000 acres from last year. Durum wheat was estimated at 10,000 acres, up 5,000 acres from 1998. Winter wheat acres are estimated at 65,000 acres, up 5,000 acres from 1998. Minnesota's barley acreage decreased 55% from last year as farmers planted 180,000 acres. This acreage is a record low for the state.

The Red River Valley experienced a prolonged period of spring rainfall that resulted in some areas not being planted and in the failure of some planted and replanted fields. High aphid (bird cherry oat aphid) populations were reported early in the season and BYVD symptoms were evident in many fields, especially in late plantings of wheat. Yellowing of flag leaves in barley caused by BYVD was also reported. Wheat leaf rust was observed throughout the state, generally at levels below 5% severity, however severities of up to 40% were reported in southern locations in Minnesota. The level of leaf rust caused concern as several spring wheats recently developed with reduced susceptibility to Fusarium head blight (FHB) were amongst those most affected by leaf rust. The T-races of leaf rust which were prevalent in Minnesota this year were first noted in 1997. Leaf spots, especially Septoria, were present on crops throughout the state and were likely as damaging as leaf rust and scab. Applications of fungicides (Tilt and Folicur) at anthesis resulted in a 10 bushel yield increase in trials in Minnesota likely resulting from the control of foliar pathogens, particularly leaf rust and Septoria, and FHB.

The first symptoms of FHB were reported in commercial fields in the first week of July however infection levels were low and remained low (generally less than 5% incidence). Losses to scab of 3 to 5 % were reported for Minnesota wheat crops. The overall losses to scab were light despite the Red River Valley receiving above average precipitation prior to heading and high dew points and occasional rain at flowering and in the early stages of grain filling. The planting of wheats with reduced susceptibility and the use of fungicides and appropriate crop rotations appear to have had some impact on the disease.

In Minnesota, a cooperative research program aimed at addressing issues related to the management and control of FHB was established in 1993 with funding from the Minnesota state legislature, the Minnesota Wheat Council, and the Minnesota Barley Council. This effort has expanded with the establishment of the US Wheat and Barley Scab Initiative.

Wheat - variety development, germplasm introduction, and biotechnology

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Breeding high yielding hard red spring wheat varieties with resistance to FHB and acceptable agronomic and end-use characteristics is a primary focus of the Minnesota wheat breeding program. Approximately 1,000 lines are tested for FHB resistance in the greenhouse annually.

Field screening for FHB resistance of approximately 400 preliminary and 150 advanced lines is conducted in replicated inoculated nurseries at three locations in Minnesota. Recent releases from the program include HJ98 (1998) and McVey (1999). HJ98 is a high yielding, medium test weight, medium protein, and medium-good quality variety with FHB resistance to spread within the head. McVey is also high yielding, with medium-low test weight, protein and quality and has resistance to the spread of Fusarium within the head.

Barley - variety development, germplasm introduction, and biotechnology
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Developing barley varieties with resistance to Fusarium and reduced levels of deoxynivalenol with acceptable agronomic and malting quality characteristics is the primary objective of the Minnesota barley breeding program. In 1999, over 1600 breeding lines were evaluated for resistance to Fusarium in replicated experiment conducted at three locations in Minnesota. These lines were derived from six sources of resistance. Currently materials from F4 populations to the advanced yield nurseries are being evaluated for resistance to FHB. MNBrite, released from this program in 1998, has partial resistance to FHB but has not been accepted as a malting variety by the brewing industry.

Biotechnology - molecular studies of host response, germplasm enhancement, and genetics of pathogenicity
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This diverse group of projects includes studies aimed at the isolation of resistance genes, mapping of resistance genes with molecular markers and the development of resistant wheat and barley varieties through genetic engineering. Transformation systems for wheat and barley have been developed and mapping of resistance genes in Chevron barley has been undertaken. Studies have been initiated to examine the pathways of floret infection of Fusarium with experiments utilizing a green fluorescent protein (GFP) labeled Fusarium isolate which facilitates observation of fungal establishment in host tissues. The diversity of Fusarium graminearum is also being examined by testing the relative aggressiveness of isolates collected throughout the US and representative strains from the world collection.

Chemical and cultural control of Fusarium head blight
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Evaluation of candidate fungicides for efficacy in suppression of FHB have been undertaken as part of a multistate cooperative effort. To successfully integrate fungicide treatments, a quantitative PCR method for estimating inoculum potential have been tested. Initial results indicate this may be useful as a decision aid to producers. Studies to examine the relationship between residue decomposition and Fusarium survival and inoculum potential on have been initiated. This study initially examined wheat residue have now been expanded to examine residues of barley and corn.