PROJECT TITLE: Plant and Variety Selection in Spring Wheat, Winter Wheat and Barley for the Control of Foliar Diseases.

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OBJECTIVES:

1. To select germplasm of winter wheat, spring wheat and barley that has improved resistance to foliar fungal and bacterial diseases that occur in Montana.

2. To incorporate the resistant germplasm into winter wheat, spring wheat and barley breeding programs so that adapted disease-resistant varieties can be developed for release to commercial small grain growers.

SUMMARY: Foliar diseases of small grains are of economic importance to small grain producers in Montana. The most prevalent of these diseases are the fungi Septoria tritici, (Septoria leaf blotch), Septoria nodorum (Septoria glume blotch) and Pyrenophora trichostoma (tan spot), the bacteria Pseudomonas syringae and Xanthomonas translucens, and wheat streak mosaic virus. No reliable estimates are available as to the economic losses caused by these diseases, but due to their widespread occurrence, losses are probably substantial.

Most of these foliar diseases are of particular significance under continuous cropping conditions, especially in combination with minimum tillage practices, because the disease inoculum appears to be carried over on crop residues or volunteer grain. Thus, there is an urgent need for identification of germplasm that is resistant to these diseases and development of resistant cultivars if continuous cropping and minimum tillage practices are to be applied successfully in Montana on a sustained basis.

Wheat disease nurseries have been grown at the Eastern Agricultural Research Center in cooperation with the Plant Pathology Department at Montana State University since 1975. Each year, 250-700 spring wheat lines and 150-500 winter wheat lines have been evaluated for disease resistance potential. Materials for the nursery are provided by Dr. A. Scharen of the Pathology Department and come from various environments, including Israel, Lebanon, Tunisia, Kenya, India, Japan, USSR, Yugoslavia, Algeria, Spain, Mexico, Brazil, Chile, Argentina, Australia and other wheat producing countries. All the disease evaluations are made by personnel from the Plant Pathology Department at Montana State University. In addition to disease ratings, other agronomic characteristics of these wheat varieties are rated by the staff of the Eastern Agricultural Research Center. The most promising lines are harvested each year and are used as a source of resistance in the breeding programs at Montana State University.

Sixty spring wheat lines were planted under irrigated conditions in 1991. The spring wheat lines were read for foliar disease infection on July 10. Disease was present and readings were made.

A barley disease resistant recurrent selection population has been grown at the

Eastern Agricultural Research Center since 1979 in cooperation with the Plant Pathology Department at Montana State University. The population was provided by Dr. David Sands. Each year, Dr. Harold Bockelman evaluated disease reaction at Sidney and selected resistant plants. The population was primarily selected for resistance to Xanthomonas translucens (bacterial leaf streak), although selection was for resistance to any disease organism. Each year, several thousand plants were grown and evaluated for disease resistance. Resistant plants were harvested and the seed produced were planted in a winter nursery in Arizona. Plants in Arizona were intercrossed and the resulting seed were planted back in Sidney in the following spring as the disease resistant recurrent selection population.

Lines from the disease resistant population were selected for good agronomic characters. A yield trial consisting of twenty lines from the barley disease resistant recurrent selection population were planted under dryland conditions in 1991. The trial was planted on April 23 and harvested on July 30.

Crosses were made in a recurrent selection population planted near Lambert, MT, in 1990. The F_1 seed were increased in Arizona. The F_2 population was planted in 1991 under irrigated conditions at the Eastern Agricultural Research Center and harvested in bulk. Seed will be sized for further evaluation.

RESULTS: A fair amount of leaf spot disease was recorded in the irrigated spring wheat nursery, much probably due to Septoria infection. Xanthomonas was abundant, and infected more wheat than barley. Leaf rust and barley yellow dwarf virus were also identified. No wheat streak mosaic virus was noted.

FUTURE PLANS: Winter and spring small grain nurseries will continue to be grown under irrigated conditions to identify germplasm with disease resistance.

Spring barley advanced lines which were selected from the disease resistant recurrent selection population will be grown in preliminary yield trials in 1992. Recurrent selection will continue in the parent population and lines with disease resistance and good agronomic characters will be selected for seed increase and yield testing.