FUNGICIDE SPRAY TRIALS FOR LEAF RUST CONTROL

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Leaf rust of wheat, a disease caused by the fungus *Puccinia recondita,* can reduce wheat yields when susceptible varieties are grown and weather conditions favor rust development. This disease is either damaging to or potentially damaging to North Dakota wheat production (11). It is a potential threat since the fungus has the ability to change and attack previously resistant varieties.

Yield losses caused by this disease have been demonstrated by comparing yields of plots in which leaf rust was controlled with fungicides, to yields of unsprayed plots (8, 9). Grower estimates of yield losses are also useful in loss estimations. The USDA Cereal Rust Laboratory also provides loss estimates for the rust diseases (5). Yield losses up to 30 percent have been reported, depending on the susceptibility of the cultivar and rust severity (1, 6, 8). Yield losses have been well correlated with rust severity (6, 8).

Epidemics can occur when susceptible varieties are grown on large acreages and environmental conditions favor rust development. Environmental factors which favor rust development are six to eight hours of moisture (dew) on leaves and favorable temperatures. Leaf rust epidemics have caused widespread losses. Paddy and Johnson (3) estimated that the leaf rust epidemic of 1956 caused losses of approximately 10 percent in Kansas. In 1965, Samborski (7) estimated a 20 percent yield reduction in late-planted fields of Selkirk in Canada. Losses of 6.8 percent were reported for North Dakota in 1965 (5). More recently Roelfs (4) reported several thousand hectars of wheat destroyed by the 1977 leaf rust epidemic in Mexico.

METHODS AND MATERIALS

Fungicide spray trials have been conducted for some time at NDSU. This paper will report spray trials conducted from 1980 to 1983 at Fargo. Each year we planted a susceptible spring wheat cultivar in drill strips 4 feet wide and 20 feet long with four replications. The field design was a randomized complete block. The wheat was planted at 60 lbs per acre, irrigated when rainfall was insufficient and fertilized for a yield goal 60 bushels per acre (bu/A). Weeds were controlled normally with Brominal at 1 pint per acre. Fungicides were applied at the boot stage. The fungicides used were mancozeb, a protectant; triadimefon (Bayleton), which has systemic properties, and several experimentals. A single application of triadimefon was normally used in the trials. Mancozeb was applied first at the boot stage and a second application 7-10 days later. Rust was evaluated several times throughout the season. Plots were harvested with a plot combine. Grain was weighed and computed to bushels per acre at 14 percent moisture.

RESULTS AND DISCUSSION

In 1980 we had good rust control at 2, 3, or 4 oz active ingredient/acre (ai/A) triadimefon. Yields were increased by controlling rust but not significantly. There was not a high level of leaf rust in 1980. Several rates of formulations of mancozeb were tested in 1980 with good control. A single application of mancozeb normally provided only fair control. Yields of all mancozeb treatments were higher than controls by as much as 7 bu/A, but differences were not significant.

In 1981, control ranged from fair to good for 1 to 4 oz ai/A triadimefon. Plots sprayed with mancozeb had only fair control. Yields were increased significantly using 1.5, 2, or 4 oz ai/A triadimefon. Yields were increased but not significantly with mancozeb.

In 1982 we had exeellent leaf rust control by applying 2 oz ai/A triadimefon. Yields were increased significantly on all plots in 1982 where rust was controlled. We had only fair control using mancozeb due to frequent rains which washed off our first application. Still, yields were increased by about 7 bu/A for mancozeb and 11 bu/A for triadimefon. In another trial, mancozeb at 1.6 lb/A plus Triton CS-7 (spreader sticker) gave good control and a 4.4 bu/A increase. We also had good control of leaf rust on barley in 1982 with 2 oz ai/A triadimefon and with mancozeb at 2 lbs/Acre.

In 1983 we obtained excellent control using mancozeb at 1.4 lb/A plus Triton CS-7. We did not report a yield increase because of environmental conditions which retarded rust development and dried the leaves shortly after our second application. We also worked with

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several experimental compounds which provided good to excellent control depending on rates and timing. Some experimental systemics as well as triadimefon need only to be applied once, saving the cost of a second application. One experimental compound evaluated as propiconazol (Tilt). Propiconazol provided excellent control in 1982 and good control in 1983. Yields were increased both years but were only significantly greater than the control in 1982. The use of a proper spreader sticker for wettable powders was also found to be very important. Proper equipment to provide good coverage is obviously essential.

Timing of fungicide applications is critical for good control. The major portion of photosynthate for kernel fill is provided by the flag (top) leaf. So, chemical control should be aimed at preventing the fungus from infecting the flag leaf. The first application should be made when the flag leaf is fully extended when plants are just starting to head. Applications made after heading usually provide unsatisfactory control unless it is the second application, and the reason for this poor control is that it takes 7-10 days for pustules to emerge after the fungus has penetrated (infected) the leaf. So, if the flag leaf is unprotected for a week, many infections will occur and produce sporulation even if a protectant fungicide is applied.

Fungicides registered for foliar application to wheat in North Dakota (1983) are mancozeb (Dithane M-45 or Manzate 200), triadimefon (Bayleton), copper hydroxide (Kocide 101 or Kocide 606) and sulfur (2). Only mancozeb and triadimefon are registered for leaf rust; both provide excellent control. Copper hydroxide provides good leaf rust control and sulfur fair control. A single application of triadimefon usually provides satisfactory control. If mancozeb or copper hydroxide is used, a second aplciation is needed in 7-10 days (2). Fungicides should be applied only if you plant a susceptible variety, expect a good crop, find the disease on lower leaves, weather conditions favor rust development, and the price of wheat will pay for fungicide application.

Varieties grown in North Dakota range from resistant to susceptible to *P. recondita.*

Most of the winter wheat cultivars grown in North Dakota are susceptible to leaf rust and may require protection by fungicides.

Research at North Dakota State University has indicated that leaf rust usually develops more slowly on durum than on susceptible hard red spring wheats (10). This slow rusting results in lower severities at the end of the season. Durum wheat yields are usually not decreased by leaf rust when final severities are less than about 20 percent. Most durums have moderately susceptible reactions with low severities but many have high levels of leaf rust in greenhouse tests and in locations south of North Dakota. So, if environmental conditions favor rust development in the field, losses could occur.

Hard red spring wheat varieties range from resistant to susceptible to the prevalent races of wheat leaf rust (2). Although most are resistant, varieties such as Nowesta, Marberg, Probrand 715, Centa, and Leader are moderately susceptible while Tioga and Prodax are susceptible. These varieties could be damaged by leaf rust.

Many of the hard red spring wheat cultivars grown in North Dakota have susceptible reactions with low severities. Higher levels of rust could cause yield losses. Since the natural rust population is changing, varieties formerly considered resistant can become susceptible due to virulence changes (11). Consult Circular A-170 Rev. "North Dakota Grain Varieties" for current varietal ratings.

The information provided herein is supplied with the understanding that no discrimination is intended and no endorsement by the North Dakota State University is implied.

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