Suppression of Corn Head Smut with Seed and Soil Treatments

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ABSTRACT

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Head smut, caused by *Sphacelotheca reiliana*, was significantly reduced by propiconazole when applied as granules in the furrow or as a surface band. Carboxin seed treatment and propiconazole as a foliar spray failed to provide significant disease reduction in trials done in 1981 and 1982. Inoculation with teliospore-infested soil applied to kernels at planting was an effective method for evaluating chemical treatments in the field.

Head smut of corn is caused by *Sphacelotheca reiliana* (Kühn) Clint., or according to Langdon and Fullerton (3), by *Sporisorium reiliana* (Kühn) Langdon & Fullerton, and was first reported in Minnesota in 1980 by Stromberg (8). It was found in four counties (Stearns, Todd, Otter Tail, and Wadena) on about 1,200 ha (9). Surveys from 1981 through 1983 detected no spread in these four counties, and it has remained at a very low incidence (R. M. Sushak, *unpublished*).

This new corn disease in Minnesota attracted attention that was due in part to the outbreak in 1979 in Ontario (4) (the first report for Canada) and concern in Minnesota about local spread and quarantine restrictions. The field trials were done at the Area Vocational Technical Institute at Staples (Wadena County). Our objective was to evaluate chemical treatments designed to manage head smut.

MATERIALS AND METHODS

All experiments were done at the University of Minnesota plots at Staples (Area Vocational Technical Institute) in a field where head smut was found in 1980. Three planting dates were chosen for each of 2 yr: 28 April and 12 and 27 May 1981 and 26 April and 11 and 24 May 1982. There were five replicates per planting in 1981 and three in 1982. These values were combined because there were not significant differences among the three dates and two years.

Corn kernels were planted in 6-m rows with 30 kernels per row to give a plant population of 11,300 plants per hectare. The soil was a sandy loam and was irrigated by overhead sprinklers once a week during the growing season. The herbicide alachlor was applied once each year to the plots.

To prepare inoculum, teliospores from the previous year were mixed with moist sandy loam characteristic of that area in a concrete mixer using the ratio of 200 parts soil to 1 part teliospores (v/v). About 120 cc of the inoculum was added after each kernel was dropped into the hand (jab) planter. This effectively covered each kernel with soilborne teliospores.

Two corn hybrids were used, one known to be susceptible and a second that was less susceptible. Seed treatments of carboxin, triadimenol (Baytan), and CGA-88531 were applied to seed using a Gustafson Lab Batch Seed treater. Propiconazole (Tilt) was applied as granules in the furrow and as a surface band both years and as a foliar spray in 1981. Data taken included plant stand, smut incidence, stunting, and phytotoxicity.

RESULTS AND DISCUSSION

Propiconazole applied as granules in the furrow or as a surface band treatment effectively reduced incidence of smutted plants in both susceptible and moderately susceptible hybrids (Table 1). As a foliar spray, however, propiconazole was ineffective in smut control. Variation in the results with propiconazole may have been due to the limited distribution or failure of the surface band treatment to completely cover the row zone (7).

Triadimenol and the experimental compound CGA-88531 as seed treatments reduced the incidence of smutted plants in both susceptible and moderately susceptible hybrids (Table 1); however,

Table 1. Effect of fungicides on percent infection by *Sphacelotheca reiliana* during 1981 and 1982

Treatment and rate	Diseased plants[a]			
	Susceptible		Moderately susceptible	
	Percent	SD	Percent	SD
Check	31.35	4.15	11.30	5.45
Carboxin[b]				
0.86	28.23	8.79	8.43	4.30
Triadimenol[b]				
0.16	15.16[c]	1.13	7.96[c]	4.99
0.32	6.66[c]	2.18	4.86[c]	0.40
0.47	3.80[c]	2.16	1.36[c]	1.06
0.63	2.93	3.47	5.20	4.80
CGA-88531[d]				
0.25	28.73[c]	2.07	6.73[c]	2.48
0.50	17.10	5.92	5.86	3.72
1.0	19.31	6.89	6.86	3.34
Propiconazole				
247[d]	26.86[c]	3.96	10.03[c]	5.20
0.025[e]	0.16	0.35	0.00	0.00
0.0125[e]	0.00	0.00	1.15	1.62
0.025[f]	2.35	1.98	1.55	1.19

[a] Each value is an average of three planting dates over a 2-yr period or 540 plants; SD = standard deviation.
[b] Grams active ingredient per gram of seed.
[c] Data from 1981 only.
[d] Grams per hectare applied as foliar spray.
[e] Grams per meter applied as granule in-furrow.
[f] Grams per meter applied as granule in surface band.

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each chemical was more effective at the higher rates of application. Triadimenol was more effective than CGA-88531, and both were more effective with the susceptible than with the moderately susceptible hybrid. Carboxin as a seed treatment did not reduce smut incidence significantly.

Chemical treatment did not affect seedling vigor, mature plant size, or percent stand. Head smut infection also did not affect percent stand. All head smut signs and symptoms described by Stromberg et al (9) were found in plants treated with fungicides. The variability we found in results from fungicide applications has also been reported by others (1,2,5,6).

Disease management is possible by using propiconazole as granules in the furrow with the kernels or as a surface band treatment. The in-furrow application may be the better method because plants have less opportunity to become infected. If registered, propiconazole could provide the farmer with a method for controlling head smut of corn other than by using smut-resistant hybrids (9). To reduce the possibility of introducing this pathogen into new areas, triadimenol could be used to treat kernels thought to be contaminated with head smut spores.

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