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WINTER WHEAT PERFORMANCE FOLLOWING SEED TREATMENT IN SOUTH CENTRAL KANSAS

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Winter wheat in the Great Plains is subject to several soil-borne diseases that may decrease stands and/or yields. Seed treatments can reduce some soil-borne diseases, as well as bunt and loose smut, which are seed-borne. However, the disease pressure varies from year to year, causing concerns about the long-term economics of seed treatments and their effects on stand and yield in years of minimal disease pressure.

Several management practices aid in controlling seedling diseases of winter wheat. These include crop rotation, proper fertility utilizing chloride or ammoniacal N, tolerant cultivars, and delayed planting. In the south central Great Plains, we lack a suitable alternate winter crop adapted to the climatic conditions. If a summer annual is used for rotation, then one crop season in three is lost. Therefore, crop rotation is not a feasible alternative for controlling soil-borne diseases in the area. Climatic conditions are such that delayed planting often leads to winterkill. Therefore, use of fungicide treatments at seeding may be the best management alternative to reduce the severity of seedling diseases in this region.

The purpose of this study was to evaluate effects of several seed-treatment fungicides on stand and grain yield of winter wheat cultivars in the central Great Plains region of the United States.

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Procedure

Field experiments were initiated in the fall of 1986 and continued through the summer of 1989. Sites were located at Kansas State University's South Central Experiment Field, near Hutchinson, KS and on a cooperating farm west of Caldwell, KS. A randomized block design with a split-plot treatment arrangement and five replications was used at both locations in all years. Six hard red winter wheat cultivars (Arkan, Hawk, Larned, Mustang, Newton, and TAM 107) were utilized in the main plots. Foundation quality seed of the six cultivars was treated in the Wilbur-Ellis Seed Laboratory, Fresno, CA. Fungicides were uniformly applied at the rates given in Tables 1, 2, and 3 using a Hege II laboratory seed treater. Untreated foundation seed from the same lots as the treated seed was used as a control. The seeds were drilled at a depth of approximately 1 in. on 7-in. centers at a rate of 60 lbs per acre in 1.75-ft by 15-ft subplots. Plots were seeded in early to mid-October each year. Emergence was evaluated by counting the number of live emerged plants per 9 ft of row (three 3-ft sections of row in the center of each subplot) approximately 3 wk after planting. Grain yield and moisture percentage data were collected by harvesting a 1.75-ft by 13-ft area of each subplot. Grain yields we converted to bu/ac at 12.5% moisture. The data fo emergence and grain yield were analyzed using split plot analysis of variance procedures to determine if any significant ($P=0.05$) interactions existed among seed treatments and cultivars.

Results and Discussion

The analysis showed significant differences in both emergence and yield among cultivars (data not presented) but revealed no significant interactions between seed treatments (fungicides) and cultivar. Therefore, comparisons of emergence and yield were averaged over all cultivars to determine the effects of fungicide. Emergence and grain yield by seed treatment varied considerably by year and location.

In 1986-87, treating the seed with fungicides did not affect emergence significantly ($P=0.05$) compared to the control, except for Nusan 30EC at the high rate (Table 1). This treatment significantly reduced the number of plants at both locations. The number of plants per acre ranged from 492,000 to 502,000 at Hutchinson and from 470,000 to 497,000 at Caldwell. The lower rate of emergence at Caldwell was attributed to the slightly wetter soil conditions at seeding. Differences in grain yield between locations were evident. Grain yields were approximately 10 bu/acre less within a treat-

Table 1. Mean emergence and grain yield of six winter wheat cultivars grown from treated and untreated seed at Hutchinson and Caldwell, Kansas during 1986-87.

Seed Treatment	Rate oz/cwt	Hutchinson Emergence Plants/ac $\times 10^4$	Hutchinson Yield Bu/ac	Caldwell Emergence Plants/ac $\times 10^4$	Caldwell Yield Bu/ac
Control	——	49.6a*	32.0a	48.9ab	23.8a
Nusan 30EC-1	0.67	49.2ab	33.0a	48.6ab	22.9ab
Nusan 30EC-2	1.25	47.9b	32.6a	47.0c	23.8a
Nusan 30EC +	0.67				
Baytan 30FL	0.33	50.2a	32.0a	48.0bc	23.3a
Nusan 30EC +	1.00				
Nu-Zone 10ME	0.75	49.6a	31.1a	47.4bc	21.5b
Baytan 30FL	0.75	50.6a	33.0a	49.7a	23.0ab
WECO 965-85	2.25	50.0a	32.9a	49.7abc	24.2a
WECO 965-85 +	2.25				
Nu-Zone 10ME	0.75	50.7a	32.7a	47.8bc	23.9a
C.V. (%)		6	14	9	16

*Values in the same column followed by an identical letter are not statistically different according to Duncan's Multiple Range Test (P=0.05).

Table 2. Mean emergence and grain yield of six winter wheat cultivars grown from treated and untreated seed at Hutchinson and Caldwell, Kansas during 1987-88.

Seed Treatment	Rate oz/cwt	Hutchinson Emergence Plants/ac $\times 10^4$	Hutchinson Yield Bu/ac	Caldwell Emergence Plants/ac $\times 10^4$	Caldwell Yield Bu/ac
Control	——	87.9a*	54.1ab	82.0a	40.0a
V-200	2.50	87.8a	54.5ab	74.4a	41.7a
Nusan 30EC	1.00	81.3ab	50.2c	75.8a	40.0a
Nusan 30EC +	0.75				
Baytan 30FL-4	0.75	79.8b	53.0bc	77.5a	43.5a
Nusan 30EC +	0.75				
Baytan 30FL-8	0.33	82.6ab	57.2a	78.1a	38.5a
Nusan 30EC +	0.75				
WECO 89565	2.00	82.3ab	53.4b	75.6a	38.3a
C.V. (%)		14	11	28	28

*Values in the same column followed by an identical letter are not statistically different according to Duncan's Multiple Range Test (P=0.05).

ment at Caldwell than at Hutchinson. Yield ranges followed those of stand, with Caldwell having a wider range (21.5 to 24.2 bu/ac) than Hutchinson (31.1 to 33.0 bu/ac). Reductions in stand usually were not reflected in grain yield. The only significant reduction in grain yield occurred with the Nusan + Nu-Zone treatment at Caldwell.

Only one fungicide treatment of seed had a significant effect on emergence in 1987-88, i.e., Nusan plus the high rate of Baytan (Table 2). However, a trend toward reduced emergence with treated seed compared to the control began to develop. Emergence ranges were wider than in the previous year. At Hutchinson, a range of 798,000 to 879,000 plants per acre was ob-

Table 3. Mean emergence and grain yield of six winter wheat cultivars grown from treated and untreated seed at Hutchinson and Caldwell, Kansas during 1988-89.

Seed Treatment	Rate oz/cwt	Hutchinson Emergence Plants/ac $\times 10^4$	Hutchinson Yield Bu/ac	Caldwell Emergence Plants/ac $\times 10^4$	Caldwell Yield Bu/ac
Control	——	61.5a*	29.9a	63.6a	48.4a
V-200	2.50	61.2a	28.9a	61.4a	49.5a
Nusan 30EC	1.00	54.7a	25.9a	51.1a	51.4a
Baytan 30FL	0.75	56.4a	30.0a	60.1a	51.1a
Benlate 50DF	1.00	56.9a	27.8a	58.2a	49.8a
PCNB	0.67	62.0a	28.7a	62.2a	47.1a
C.V. (%)		19	19	20	23

*Values in the same column followed by an identical letter are not statistically different according to Duncan's Multiple Range Test ($P = 0.05$).

served. Stands at Caldwell, as in the previous year, had lower emergence figures, with a range of 744,000 to 820,000 plants per acre. When compared with the control, only one significant reduction in grain yield occurred, i.e., the Nusan 30EC treatment at Hutchinson.

In 1988-89, the trend for reduced emergence with treated seed continued to express itself (Table 3). However, as in previous years, treating the seed with fungicides resulted in no statistically significant reduction in stand. Under less than ideal conditions for emergence (dry soil), ranges were much narrower and differences in emergence between locations were less than in previous years. This indicates that the effects of seed-applied fungicides on emergence are greater under moist soil conditions. Grain yields at Hutchinson were considerably lower than in previous years and, for the first time during the study, fell below those at Caldwell. A sudden drop in temperature (from 82°F on February 1 to -20°F on February 2, 1989) had a more severe effect on plants at Hutchinson than at Caldwell.

Conclusions

The results of this study indicate that fungicide treatment of seed of dryland winter wheat planted in the south central region of the Great Plains does not significantly affect the number of seeds that germinate and produce viable (emerged) plants. No consistent effect of seed treatment on grain yield was observed. Treatments that reduced stand did not result in reduced yield, and reduced yields occurred where there were no reductions in stand.

Because all the tested cultivars responded similarly to the fungicide treatments, limited precautions probably are necessary in treating seed from cultivars with the same genetic background.

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