Evaluation of fungicide seed treatments on flax cultivars differing in seed color

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INTRODUCTION

Flax cultivars with light colored seeds have been reported to have lower germination, less vigor, and lower field emergence than cultivars with dark colored seed (1, 2, 3, 6, 7, 8). Some of these observations have also been made at the NDSU Langdon Research Extension Center (Halley and Lukach, personal observations). Beneficial effects of the use of fungicide treatments on flax seed such as greater germination and field emergence have been reported (4, 5, 6). Although registered fungicide seed treatments for use on flax in North Dakota are available, little information has been available on their efficacy in a North Dakota environment. The objective of this project is to evaluate four fungicide seed treatments and an untreated control on yellow and brown seed type flax cultivars.

METHODS

Field research was conducted at the NDSU Research Extension Centers located in Langdon and Carrington, ND. The seed treatment fungicides Captan, Thiram, Dithane, and Maxim were applied to seeds of flax cultivars Omega (yellow seed) and York (brown seed) as slurries in early Spring 2003. Plots were planted 28 Apr 2003, 16 May 2003, 2 May 2004, 10 May 2004 at Langdon and Carrington, respectively. Plant stand was measured by counting the number of plants in 3 ft section of row in each plot. Roots from 5 flax plants were collected from each plot. Roots were washed and evaluated for disease using a 0 to 4 rating scale. A disease severity index (DSI) was calculated for each plot by: (mean severity X incidence %) / 4. Lesioned roots were surface-sterilized with a 10% Clorox solution for 1 min., rinsed with sterilized distilled water, and placed on potato dextrose agar for isolation of pathogens. Plots were harvested and yield was determined. Plots were organized in a randomized complete block design with 6 replications at Langdon and 4 replications at Carrington. Data were statistically analyzed using the general linear model procedure (PROC GLM) in SAS (SAS Institute, Inc., Cary, NC).

RESULTS AND DISCUSSION

Langdon 2003. There were no significant ($P \leq 0.05$) cultivar by seed treatment interactions; therefore, main effects only are presented. There were significant differences between cultivars for disease severity index (DSI), test weight, and yield (Table 1). There was not a significant difference between cultivars for plant stand. There were no significant differences among fungicide seed treatments for any of the measured parameters (Table 2).

Langdon 2004. There were no significant ($P \leq 0.05$) cultivar by seed treatment interactions; therefore, main effects only are presented. There were no significant differences between cultivars for any of the measured parameters (Table 3). Significant differences among seed treatments occurred for disease incidence, disease severity, and DSI, but not for stand or yield (Table 4). Plots planted with Dithane treated seed had significantly less disease incidence than plots treated with untreated seed. Plots planted with seed treated with any of the fungicides had significantly lower disease severity and DSI than the untreated control.

Carrington 2003. There were no significant ($P \leq 0.05$) cultivar by seed treatment interactions; therefore, main effects only are presented. There were significant differences between cultivars for DSI and oil concentration (Table 5). No significant differences between cultivars were detected for plant stand, test weight, or yield. There were no significant differences among fungicide seed treatments for any of the measured parameters (Table 6).

Carrington 2004. No significant ($P \leq 0.05$) cultivar by seed treatment interactions was detected; therefore, main effects only are presented. Significant differences were detected between cultivars for yield, but not for any of the other measured parameters (Table 7). Cultivar Omega had significantly greater yield than cv. York. No significant differences were detected among seed treatments for any of the measured parameters.

In general, fungicide seed treatments did not provide many benefits over the untreated control. Although root disease was reduced by fungicide seed treatments at Langdon in 2004, yield benefits were not observed. The cultivar York tended to perform slightly better at Langdon; however at Carrington, the two cultivars performed very similar. In general, no effects of seed color or fungicide seed treatments were observed in this study that is cause for making any new flax production recommendations.

LITERATURE CITED

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Table 1. Cultivar effects combined across all seed treatments on stand, root disease, test weight, and yield at Langdon, ND in 2003.

Cultivar	Stand (plants/A)	DSI[a]	Test weight (lb/bu)	Yield (bu/A)
Omega	1,987,738	32.6	52.1	11.6
York	1,956,328	23.6	53.1	18.1
P > F	0.8631	0.0221	0.0001	0.0001

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 2. Seed treatment effects combined across all cultivars on stand, root disease, test weight, and yield at Langdon, ND in 2003.

Treatment	Stand (plants/A)	DSI[a]	Test weight (lb/bu)	Yield (bu/A)
Untreated	1,985,280	26.3	52.8	15.1
Captan	2,047,320	28.5	52.8	13.5
Dithane	1,870,660	25.2	52.5	15.3
Maxim	1,938,420	32.3	52.3	16.6
Thiram	2,018,280	28.3	52.6	14.3
P > F	0.9092	0.7996	0.3800	0.3083

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 3. Cultivar effects combined across all seed treatments on stand, root disease, and yield at Langdon, ND in 2004.

Cultivar	Stand (plants/A)	Disease incidence (%)	Disease severity (0-4)	DSI[a]	Yield (bu/A)
Omega	1,587,036	72	1.1	23	18.4
York	1,627,692	67	0.8	15	18.9
P >F	0.5125	0.7010	0.0824	0.0651	0.5532
LSD 0.05	NS	NS	NS	NS	NS

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 4. Seed treatment effects combined across all cultivars on stand, root disease, and yield at Langdon, ND in 2004.

Treatment	Stand (plants/A)	Disease incidence (%)	Disease severity (0-4)	DSI[a]	Yield (bu/A)
Untreated	1,648,020	82	1.4	31	18.1
Captan	1,460,470	72	0.9	17	19.8
Dithane	1,660,120	47	0.7	14	18.3
Maxim	1,605,670	75	0.9	18	18.9
Thiram	1,662,540	68	0.8	15	18.2
P >F	0.2088	0.0232	0.0171	0.0349	0.7074
LSD 0.05	NS	21	0.4	12	NS

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 5. Cultivar effects combined across all seed treatments on stand, root disease, test weight, yield, and oil concentration at Carrington, ND in 2003.

Cultivar	Stand (plants/A)	DSI[a]	Test weight (lb/bu)	Yield (bu/A)	Oil (%)
Omega	986,000	14.7	52.0	13.6	39.8
York	982,000	4.3	51.5	11.9	37.8
P > F	0.9510	0.0004	0.1805	0.1281	0.0109

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 6. Seed treatment effects combined across all cultivars on stand, root disease, test weight, yield, and oil concentration at Carrington, ND in 2003.

Treatment	Stand (plants/A)	DSI[a]	Test weight (lb/bu)	Yield (bu/A)	Oil (%)
Untreated	1,066,000	8.3	52.0	13.3	40.2
Captan	920,000	8.4	51.7	11.5	37.9
Dithane	1,053,000	10.9	51.3	14.7	39.3
Maxim	875,000	7.1	51.7	11.9	37.3
Thiram	1,006,000	12.8	52.0	12.1	39.0
P > F	0.1840	0.6478	0.6088	0.2449	0.0565

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 7. Cultivar effects combined across all seed treatments on stand, root disease, and yield at Carrington, ND in 2004.

Cultivar	Stand (plants/A)	Disease incidence (%)	Disease severity (0-4)	DSI[a]	Yield (bu/A)
Omega	1,333,741	48	0.6	11	5.7
York	1,280,429	50	0.7	13	3.9
P >F	0.2270	0.8393	0.7788	0.6841	0.0023
LSD 0.05	NS	NS	NS	NS	1.2

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.

Table 8. Seed treatment effects combined across all cultivars on stand, root disease, and yield at Carrington, ND in 2004.

Treatment	Stand (plants/A)	Disease incidence (%)	Disease severity (0-4)	DSI[a]	Yield (bu/A)
Untreated	1,297,219	65	0.9	18	4.6
Captan	1,360,776	65	0.9	19	4.8
Dithane	1,267,812	28	0.3	2	5.1
Maxim	1,346,072	48	0.5	8	4.6
Thiram	1,263,544	40	0.7	13	4.9
P >F	0.5040	0.0938	0.1403	0.1637	0.9167
LSD 0.05	NS	NS	NS	NS	NS

[a] DSI, Disease severity index, for root diseases was calculated for each plot by: (mean disease severity based on a 0 to 4 scale X disease incidence %) / 4.