WINTER WHEAT SEED TREATMENTS FOR WISCONSIN

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INTRODUCTION

Winter wheat production in Wisconsin either for seed or for grain requires careful management in order to be profitable. Seed, soil and air borne diseases of wheat can cause significant yield reductions if not managed properly. Weather conditions, quality of seed, cultural practices, and levels of disease inoculum all affect the levels of disease pressure in any given year. Wisconsin climate and soil types make wheat very prone to many seedling root , foliar, and head diseases. In addition, many winter wheat varieties lack significant resistance to common diseases.

DISEASE CONTROL

Many wheat diseases common to Wisconsin can be managed with proper cultural practices, planting disease free seed, and use of chemical fungicides on the seed or in foliar applications (Table 1). Proper crop rotations and using disease free seed are important first steps in controlling pathogens. Selecting disease resistant varieties using seed company information or university recommendations will also help alleviate some disease problems.

Table 1. Common wheat diseases of Wisconsin and source of pathogen inoculum.

Disease name	Pathogen	Inoculum Source
Common bunt	fungus	seed and soil borne
Loose smut	fungus	seed borne
Scab (seedling and head blight)	fungus	residue, seed, soil
Septoria glume blotch	fungus	residue, seed
Powdery mildew	fungus	residue
Leaf and stem rust	fungus	airborne spores from south
Barley yellow dwarf	virus	vectored by aphids

SEED TREATMENTS

Fungicide seed treatments are available to control most soil and seed borne fungi. Quick seedling emergence and uniform stands are necessary to maximize yield. Protection of the young seedling will increase winter survival rates and promote better tillering, which contributes greatly to yield. A number of fungicide seed treatment products are available for control of early season seed and seedling problems; however, a single fungicide will not control all of the pathogens present. Many commercial formulations are complementary, combinations of ingredients in order to provide a broader spectrum of protection.

The advantages for using a fungicide on wheat seed are thought to be greater when the seed and young seedling are placed under stress due to cool damp soil conditions. Fungicide seed treatments are also recommended to increase seed viability when higher germination rates are needed to meet seed quality standards. Little has been said however, about the impacted of these treatments on the yield potential of good quality wheat seed grown under favorable conditions.

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Some disadvantages for fungicide seed treatments include cost, toxicity, and difficulties of disposal of unneeded treated seed. It cannot be feed to livestock or enter the human food chain. The economic return for seed treatments must be weighed carefully before investing time and money in the process.

Insecticide seed treatment can also be beneficial to winter wheat yields. Barley yellow dwarf virus (BYDV) is a disease disseminated by aphids and can cause severe economic damage to wheat production. Gaucho® (imidacloprid-Gustafson) is an insecticide seed treatment labeled for control of early season aphids on wheat. The aphids move the BYD virus from summer host crops such as volunteer wheat, corn, and many grass species to newly emerged wheat plants in September and through feeding, transmit the virus to the wheat. Imidacloprid provides some systemic control of the aphids while they are feeding on the wheat.

RESULTS OF TWO YEARS OF FUNGICIDE SEED TREATMENT TRIALS

2000 Results

Three varieties of winter wheat (Glacier, Kaskaskia, and Kaltenberg KW39) were planted at Arlington and Janesville, WI to compare the effectiveness of Raxil/Thiram (R/T) and Raxil/Thiram plus Gaucho (R/T/G) seed treatments. Raxil/Thiram is a broad-spectrum fungicide with excellent control of smut and bunt and fair to good control of *Pythium* and *Fusarium* seedling blight. Gaucho is an insecticide for suppression or control of aphids. Varieties were significantly different in their response to seed treatments. The R/T treatment significantly increased the yield of Glacier over the untreated control (55.5 vs. 59.2 bu/a), but not of Kaskaskia or KW39 when averaged across locations (Fig. 1a). Adding Gaucho to the mix increased the yield of Glacier by 8.8 bu/a and KW39 by 2.7 bu/a over just the R/T seed treatment.

In 1999, the variety Glacier was planted at three planting dates (Sep. 1, Sep, 17, and Sep. 30) at Arlington to compared seed treatment response to date of planting. Over all seed treatments, the Sep. 30 planting date yielded 67.8 bu/a which was 10.4% higher than the Sep. 17 planting date and 48% higher the Sep. 1 planting date (Fig. 1b). The late-planted wheat had higher yields probably because it escaped feeding by the aphids and the subsequent virus transmission. There were no significant yield differences due to seed treatment at any of the planting dates.

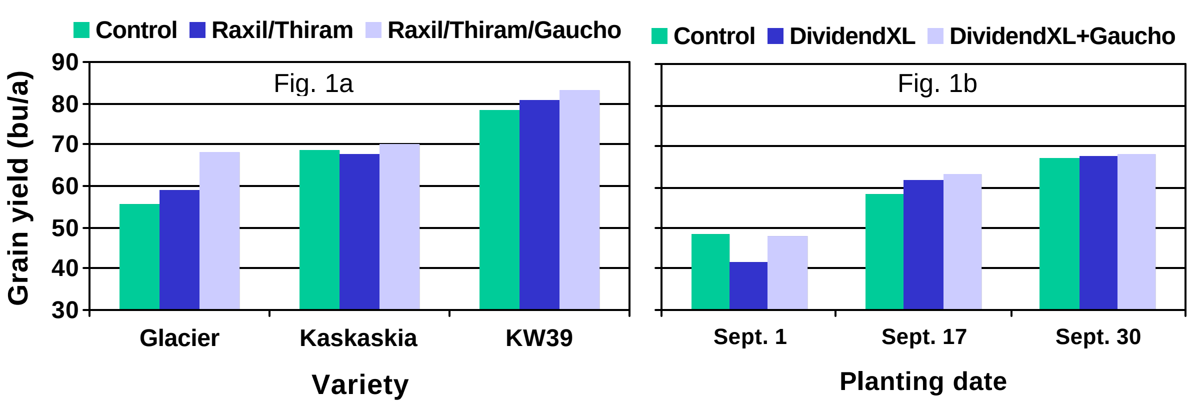

Fig. 1. Effect of fungicide and insecticide seed treatments on the yield of winter wheat. Wisconsin. 2000.

2003 Results

The wheat variety "Hopewell" was planted on September 24, 2002 at the Arlington Research Station. Seeding rate was 1.5 million seeds/acre. Thirteen combinations of three seed applied insecticides (Gaucho XT, Gaucho 480, and Cruiser) and six seed applied fungicides (Raxil-Thiram, Raxil MD, Raxil MD Extra, Vitavax 200, Dividend Extreme, and Dividend XL) were compared against an untreated control. Germination rates of the 14 treatments were test and no effect on seed germination was seen. (Fig. 2).

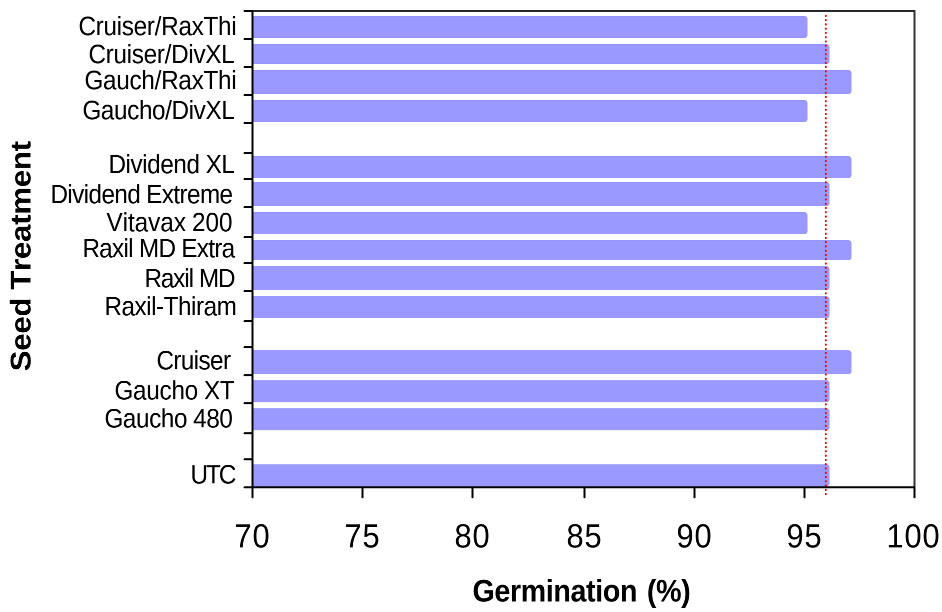

Fig. 2. Effect of various seed applied insecticides and fungicides on seed germination. Wisconsin. 2003.

All treatments significantly increased wheat test weight compared to the control. As a group, 4 treatments containing a combination of an insecticide and a fungicide raised the test weight 2.1 lbs/bu over the control. Six treatments containing only fungicide seed treatments increased the test weight 1.3 lbs/bu over the control (Fig. 3) Wheat yields were greatly affected by fungicide and seed treatments used individually and in combinations. As a group, 4 treatments containing a combination of an insecticide and a fungicide increased yielded 11.7 bu/a (15%) over the control (79.2 vs. 90.0 bu/a). Six treatments containing only fungicide seed treatments increased the yield 6.6 bu/a over the control (Fig. 4)

SUMMARY

Seed applied fungicides are effective against many disease pathogens of wheat found in Wisconsin, however they are only sometimes economically feasible. Over 11 trials with various seed applied fungicides, treated seed yielded 1.7 bu/a more than the control (Table 2). Only one trial has been conducted where an insecticide-only treatment is used, so no conclusions can be made yet on the effectiveness of insecticides. Further work needs to be done to detect any effect of insecticides separate from fungicides. Where seed applied fungicides and insecticide were used in combination, over three separate trials, treated seed out yielded untreated seed by 6.8 bu/a.

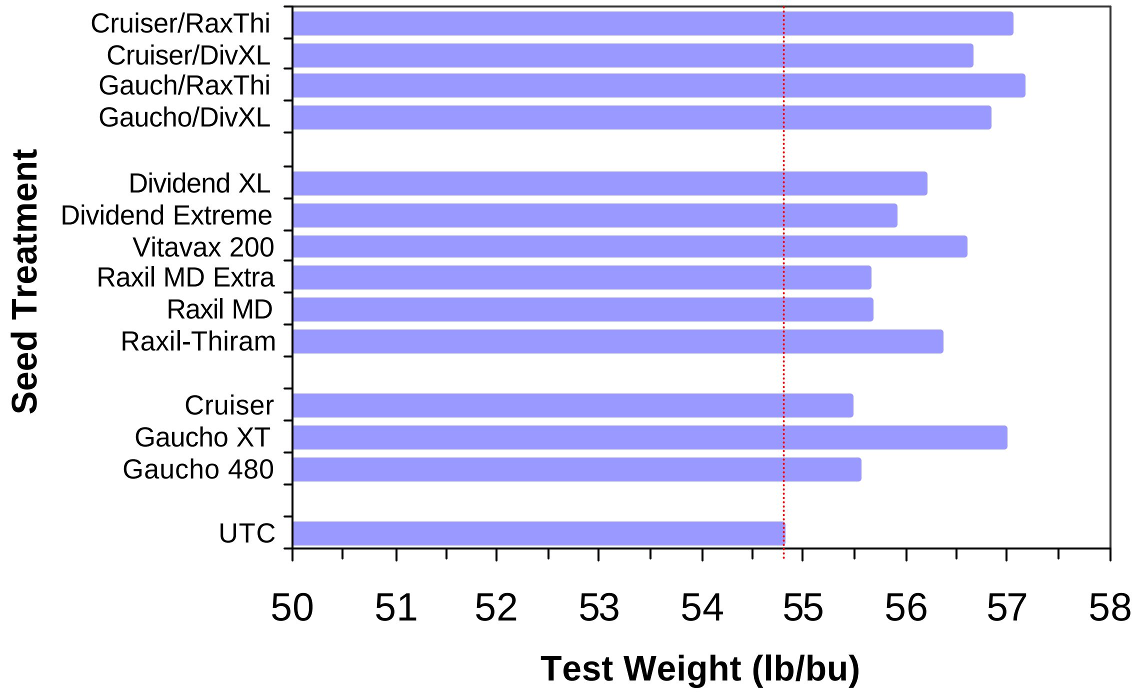

Fig. 3. Effect of various seed applied insecticides and fungicides on test weight. Wisconsin. 2003.

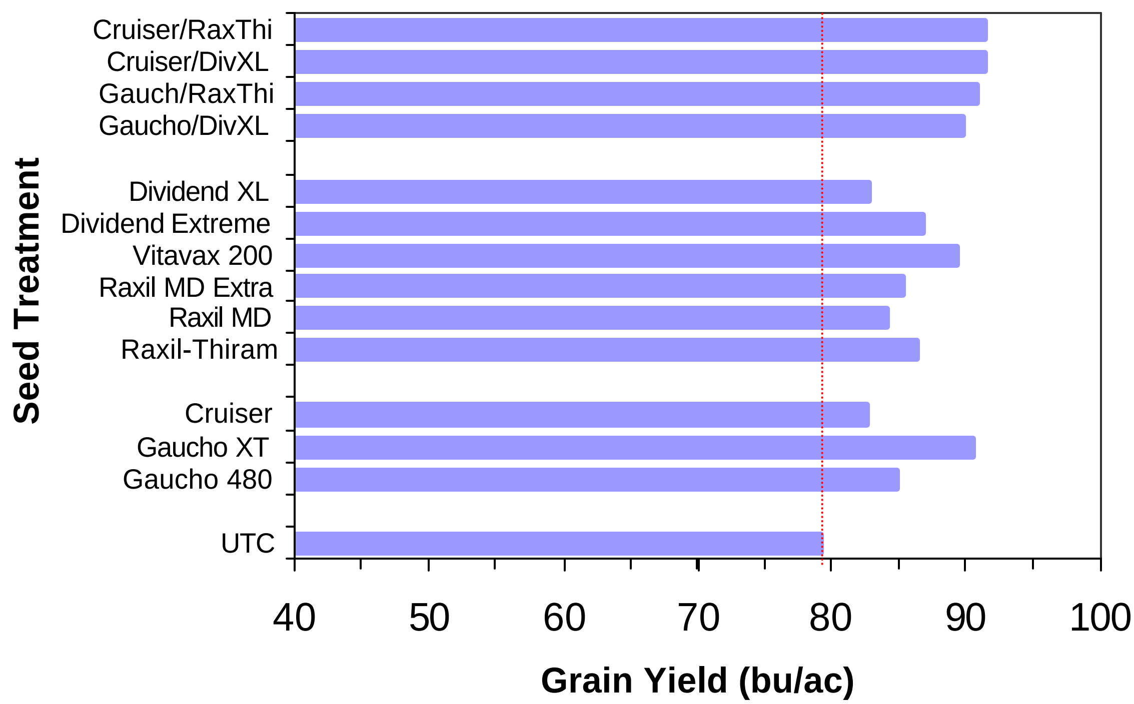

Fig. 4. Effect of various seed applied insecticides and fungicides on winter wheat yields. Wisconsin. 2003.

The eleven studies reported on in this paper were planted using high quality seed for all treatments. However, other sources of pathogenic inoculums caused yields to differ among treatments on several experiments. Positive yield responses to fungicide seed treatments in 1999 and 2003 (Table 2) indicate that seed treatments were especially valuable in years with high overall yields,. Correlation analysis over all experiments (not shown) reveals a positive and significant ($p<0.05$) relationship between the yield of the control plots and the yield response to fungicide seed treatments. These findings suggest that treating healthy wheat seed would be particularly advantageous in years when good growing conditions exist. Years when poorer environmental conditions exist, wheat yields are stymied and seed applied fungicides can protect, but not maximize yield.

Because it is impossible to predict future weather conditions when planting wheat, the decision to use fungicide or insecticide seed treatments should be based on historical trends. The average yield response obtained from fungicide seed treatment over these 11 experiments was 1.7 bu/ac. Common fungicide seed treatments will cost about $3.00 to $6.50/a. Growers should consider the economic return of using fungicide seed treatment even when planting good quality seed.

The cost of insecticide seed treatments can range from approximately from $13 to $26/a. However, there is not a good estimate of yield response to insecticide seed treatment of winter wheat in Wisconsin. Preliminary data (three years only) suggest a yield response of 4.2 bu/ac.

The use of good management practices such as crop rotation and selection of disease resistant seed are critical regardless of the decision made on seed treatments. Further studies should be initiated to determine the effect of seed treatments on poor quality seed and to establish a better estimate of potential yield response to insecticide seed treatment on winter wheat in Wisconsin.

Table 2. Summary of Wisconsin winter wheat seed treatments from 1988 to 2003.

Year	1988	1989	1990	1991	1993	1996	1997	1998	1999	2000	2003
Variables	1 env 2 var 3 trts	2 env 2 var 4 trts	1 env 2 var 2 trts	1 env 2 var 9 trts	2 env 26 var 3 trts	2 env 2 var 3 trts	4 env 2 var 3 trts	4 env 2 var 3 trts	4 env 3 var 4 trts	2 env 3 var 3 trts	1 loc 1 var 14 trts
						bu/ac					
Check	48.0	62.3	43.2	59.0	51.2	57.4	67.2	49.0	85.0	67.6	79.2
Fungicides	2.3	0.7	-0.4	2.3	-0.6	3.3	0.8	0.5	2.0	1.2	6.6
Insecticides											6.8
Ins + Fung									2.6	6.2	11.7

Average over 11 experiments = gain 1.7 bu/a

3-exp avg gain 6.8 bu/a

Other Sources of Information UWEX Pest Management in Wisconsin Field Crops-2004
http://cecommerce.uwex.edu/pdfs/A3646.PDF