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Winter Wheat Cropping System Response to Seed Treatments, Seed Size and Sowing Density

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Introduction

There is disagreement between anecdotal reports regarding the influence of seed-applied fungicides, insecticides or combinations of both on winter wheat (*Triticum aestivum* L.) crop growth and vigour. Our objective was to determine the influence of dual fungicide/insecticidal seed treatments, sowing density and seed size on fall stand establishment and overwinter survival of winter wheat.

Materials and methods

In the fall of 2010, experiments were established at seven sites across the Canadian prairies. The three factor experiment consisted of two levels of seed treatment 1) Check – no seed treatment, and 2) dual fungicide/insecticidal seed treatment: tebuconozole + metalxyl + imidacloprid ('RaxilWW'); two levels of sowing density 1) 200 seed m^{-2}, or 2) 400 seeds m^{-2}; and three levels of seed size (small, medium, and large) as a proxy for seed vigour. The combined factors create a range of agronomic systems (Figs. 1 and 2) from weak (low seed rate, small/thin seed, no seed protection) to superior (high seed rate, heavy/plump seed, dual seed treatment).

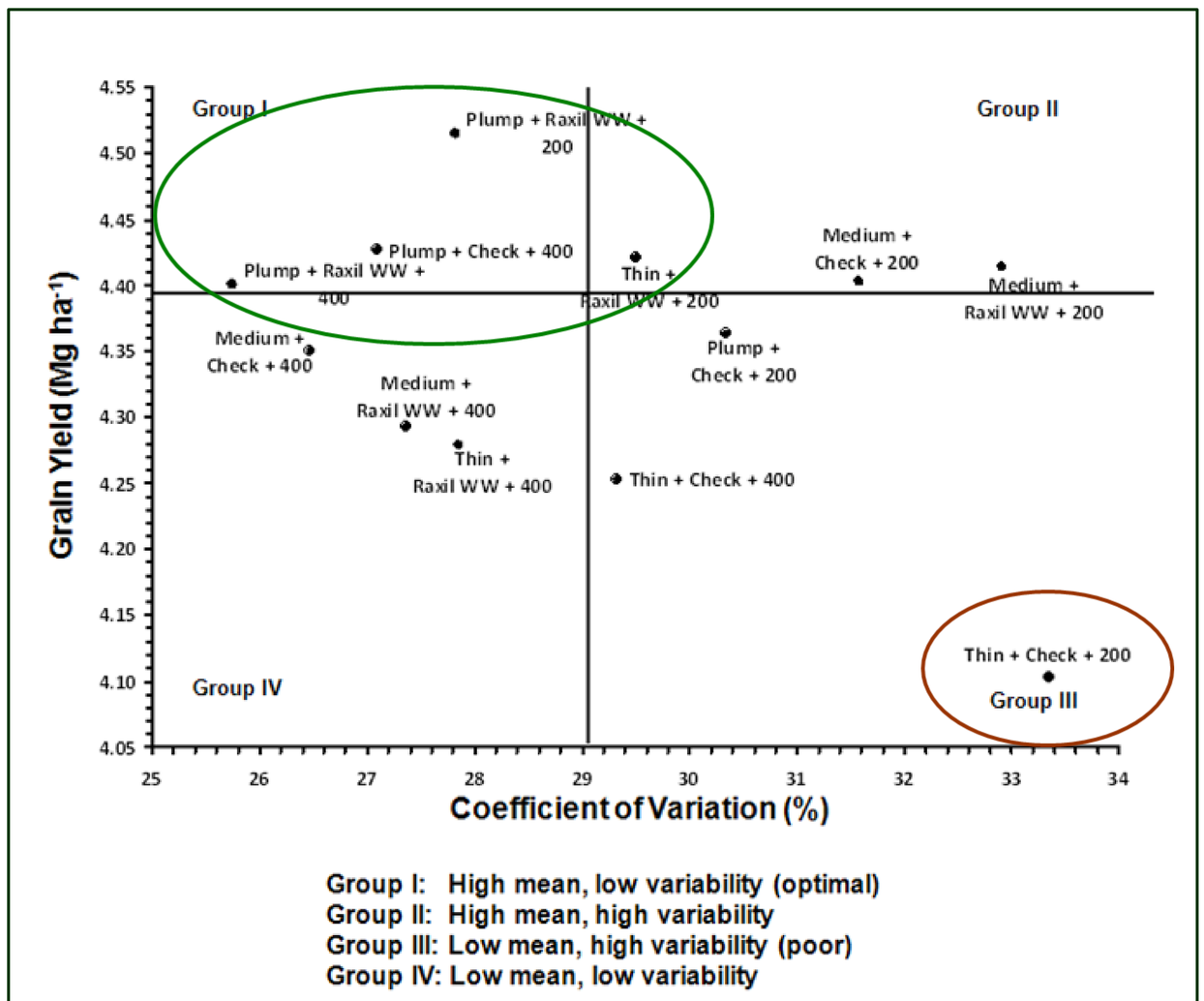
A combined mixed model analysis was performed using SAS® version 9.2 (treatment effects fixed; rep, env. and their interactions random). A biplot was generated using grain yield vs. coefficient of variation (CV) to assess overall stability of the agronomic system.

Fig. 1. Weak agronomic system of low sowing density and light seed with no seed treatment (left photo) or with dual fungicide/insecticide ('Raxil WW') (right photo).

Fig. 2. Strong agronomic system of high sowing density and heavy seed with no seed treatment (left photo) or with dual fungicide/insecticide ('Raxil WW') (right photo).

Results and discussion

- Crop growth and vigour responses were greatest in the weak agronomic system and tended to diminish with a stronger agronomic system (Fig. 1).
- Grain yield was strongly affected by seed treatment (P=0.02), weakly influenced by seed size (P=0.08), and not affected by seeding rate. The strong response to seed treatment at low density (Fig. 1) compared to higher densities (Fig. 2) may explain why the main effect for seeding rate was NS (data not shown).
- The stability and overall productivity of a weak agronomic system (thin seeds and low seeding rate) was improved with seed treatments (red circle vs. green circle) (Fig. 3). However, if seed size was large and a higher seeding rate was used, there was no gain in grain yield but a slight increase to system stability did occur with the seed treatment (Fig. 3).



Group I: High mean, low variability (optimal)
Group II: High mean, high variability
Group III: Low mean, high variability (poor)
Group IV: Low mean, low variability

Fig. 3. Biplot of grain yield vs. coefficient of variation for each treatment combination of seed size (Plump, thin, or medium), seed treatment (Raxil WW vs. no seed treatment) and seeding rate (200 seeds m^{-2} or 400 seeds m^{-2}).

Conclusions

The results underscore the importance of proper agronomic methods for winter wheat production in the northern Great Plains, including optimum sowing densities and healthy seed lots. Seed treatments could enhance productivity, particularly if the agronomic system is compromised with less than desirable seed lots, lower plant populations, or perhaps other components not assessed in this study.

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