Developing an Environmental Specific Decision Support Tool to Help Growers Determine an Optimum Seeding Rate for New Varieties

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Research Questions

There are many new varieties of spring wheat released each year. Research has shown that the optimum seeding rate of a variety can vary significantly from the general extension recommendation. Conducting research to determine the optimum seeding rate for each new variety, however, is not practical as this type of research is expensive and time consuming. Furthermore, recent research has clearly demonstrated the impact that the environment (average yield, latitude, precipitation, etc) can have the seeding rate requirement to produce maximum yield. This research will attempt to develop a decision support system for growers so that they can more accurately predict the optimum seeding rate for each selected variety based on the characteristics of the variety and the environment in which it will be sown. Accordingly, the main research question is: Can environmental information together with the genetic and phenotypic factors of a variety be used to determine the optimum seeding rate for that variety for the field in which it is sown?

Results

Data obtained from 11 experiments conducted during the 2017 and 2018 growing seasons. The highest yielding seeding rate, when averaged over locations, was 1.75 million seeds per acre. The difference in yield between the lowest seeding rate (0.75 million seeds per acre) and the highest seeding rate (2.25 million seeds per acre) was 1.9 bu per acre. Varieties did vary in their optimum seeding rate, but differences tended to be small and not consistent across environments. Additional analysis is needed prior to the development of the decision tool as part of this project.

Application and Use

This research has the potential of helping growers optimize the seeding rate for each variety grown. We now have the data needed to allow for the development of a decision tree, taking into account the various factors that are known to influence a variety's response to seeding rate. Factors that might be included in this "tree" include: the yield potential of the area, the latitude of the farm, the normal height of the variety of interest, its tillering potential and maturity length. Also to be included will be key genetic traits of the variety. The results and application of this research should allow growers to use seeding rates that optimize yield and eliminate the cost of using more seed than is needed for optimum yield.

Materials and Methods

Experiments were planted in 12 locations (8 in North Dakota and four in Minnesota). These sites varied in their historic yield potential. One experiment was lost due damage from rodents. Treatments consisted of a factorial combination of varieties (nine) and seeding rates (four). The varieties included were: Prevail, Vit-Pro, Valda, Linkert, Lang, Surpass, Anchor, Wildfire and Shelly. These are relatively recently released varieties that varied for key genetic and phenotypic traits, specifically semi-dwarf genes Rht-B and Rht-D, photoperiod gene Ppd-D, straw strength, and tillering capacity. The seeding rates used were 0.75, 1.25, 1.75. and 2.25 million seed per acre: In addition to obtaining information on the best seeding rate for maximum yield for each variety in each environment, we collected data on the tillering capacity of each variety, measured plant height, and recorded data on lodging. The sites in western ND were included in order to obtain critical information on the effect of seeding rate on yield in lower yielding environments.

Economic Benefit to a Typical 500 Acre Wheat Enterprise

We are still in the preliminary stage of the analysis of the research results. Ultimately, we believe that there will be a twofold benefit from this research. The first will be the benefit of additional yield arising from growers using the optimum seeding rate for the variety and environment, the second is the potential saving in the cost of seed used, if the grower had been using more seed than is found to optimum.

Related Research

This research builds on previous research on the same subject conducted recently but includes more recently released genotypes and environments that are more diverse.

Recommended Future Research

A more detailed analysis of the data is needed. The development of a decision tree will be an important next step. A more detailed analysis of the effect of tillering capacity of a variety on its optimum seeding rate is needed as well as a better understanding on how seeding rate impacts tillering of a variety when grown under differing seeding rates.

Appendix

Table 1. Effect of seeding rate and variety on yield of spring wheat, average of 10 location/years, 2017-18.

	Seeding rate (million seeds/ac)			
	0.75	**1.25**	**1.75**	**2.25**
Anchor	43.1	41.3	44.1	40.7
Lang-MN	49.3	52.8	51.5	51.6
Linkert	47.2	48.2	50.8	49.7
Prevail	50.6	52.2	50.5	52.4
Shelly	50.8	53.9	53.8	53.6
Surpass	50.2	52.6	54.1	51.7
Valda	53.4	56.8	57.7	56.1
VitPro	49.0	49.5	49.6	51.4
Wildfire	48.2	50.4	52.0	51.6
Average	49.1	50.9	51.6	51.0