Refining Nitrogen Recommendation Zones for Hard Red Spring Wheat in Minnesota

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Research Questions

An underlying assumption of any recommendation is that the area for which the recommendation is made is relatively uniform. The outcomes experienced by individual growers at any location within the target area should be close to the expected outcome predicted by the recommendation.

Minnesota’s current HRSW N recommendations divide the state in two zones or target areas; an eastern zone where the soil nitrate test is not appropriate and a western zone where the soil nitrate test is used. Variability in the original 69 site-year data set, used to develop the current N recommendation, as well as anecdotal evidence of growers suggests considerable variation in optimum N rates across the western zone. Therefore, it is warranted to explore this variation in more detail, a prerequisite to more nuanced N management recommendations in the future. Since HRSW grain protein responds linearly over a wider range of available N, we selected grain protein as the response variable by which to measure this variation rather than grain yield.

Results

Initial results indicate that the survey created enough participation to create a robust, balanced dataset. The response rate was 8.5% and 6.1% for the number of sample bags mailed in 2010 and 2011, respectively. The initial analysis of the unadjusted grain protein content pointed to a geospatial pattern within the western N management zone in 2010. The initial host spot analysis of the unadjusted grain protein content did not reveal any spatial pattern within the western N management in 2011. The 2011 data revealed a bimodal rather than a normal distribution as was the case in 2010. This suggests that there is an underlying effect that obscures any spatial pattern in 2011. Hence, additional analyses of the data are warranted before the 2011 is dismissed as a total loss.

Materials and Methods

In collaboration with the Minnesota Wheat Research & Promotion Council a mail survey was conducted.

Map 1: Distribution of samples in 2010

Map 2: Distribution of samples in 2011.
during the 2010 and 2011 HRSW harvests. Each survey kit contained 5 sample bags/surveys and 2 pre-paid return envelopes (Photo 1). Producers were asked to return a grain sample, one bag representing one field, as well as information about the field from where the sample originated. A total of 4242 and 5096 survey kits were mailed to producers in June of 2010 and 2011, respectively. Reminder cards were mailed 3 and 6 weeks later. Regional media was used to create awareness and encourage participation.

Producers were asked to record the geographic location of the sampled field and share information about the variety, planting date, and amount and source of N applied. With few exceptions, producers recorded field locations using civil township names and section numbers. Where appropriate the ¼ section and ½ quarter section were also documented.

Grain protein was determined on the received samples using NIR. Civil Townships were converted to Public Land Survey (PLS) Township and Range and an attribute field was added to the sampled field data set that accounted for the county, township and range, section, quarter section, and quarter-quarter section geographic location. This data set was joined in ArcView 9.2 to the PLS quarter-quarter section data set obtained from the Minnesota DNR Data Deli.

Grain protein from the mapped fields was subjected to two geostatistical procedures. First, a Getis-Ord Gi* Hotspot analysis completed on the data (Map 2) then the same data were subjected to several interpolation methods. The lowest residual mean square (a measure of error) was obtained with the spherical model type of ordinary Kriging (Map 3).

Related Research


Recommended Future Research

The principal investigators are evaluating whether to repeat the survey for a third year.

Publications