Refining Nitrogen Recommendation Zones for Hard Red Spring Wheat in Minnesota

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Research Question

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 overall response rate was 8.5% for the number of sample bags and 12% for the number of respondents. Initial analysis of the unadjusted grain protein content points to a geospatial pattern within the western N management zone.

Materials and Methods

In collaboration with the Minnesota Wheat Research & Promotion Council a mail survey was conducted during the 2010 HRSW harvest. 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 survey kits were mailed to producers in June of 2010 and 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 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. Of the 1799 total grain samples received only 1388 found a matching PLS quarter-quarter section record. The distribution of these 1388 sample fields in NW Minnesota are illustrated in Map 1. Grain protein from the mapped fields was subjected to two geostatistical procedures. First a Getis-Ord Gi* Hotspot analysis completed (Map 2) and several interpolation methods were on the same data. The lowest residual mean square (a measure of error) was obtained with the spherical model type of ordinary Kriging (Map 3).

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