Optimizing Winter Wheat Management

(Funded 2011)

Principal Investigator:

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Purpose:

In 2011 the emphasis of this research effort will deal with four aspects impacting wheat producers.

- The first is a calibration of seeding rates for hard-red winter wheat.
- The second is evaluating hard-red spring wheat response to foliar and seed placed copper.
- The third is the initiation of a study to look at the potential impact of sulfur fertilization on winter wheat yield and flour quality.
- The last aspect will be an evaluation of the potential for low rates of chloride fertilizer to reduce early season disease pressure.

Background:

Hard wheat (both winter and spring) are a cornerstone crop in MOST of South Dakota. This will likely continue into the future. Hard wheat is predominately a human edible food. This contrasts with the feed and industrial utilization that defines many of the other crops grown in the State. This means that the impact of production practices as they relate to quality parameters are potentially as important as those that impact yield. Quality in the case of wheat refers to factors that impact bread making characteristics and also those that influence the nutrient density of the finished product. The latter factor will become more important as consumers become more conscientious regarding their diet.

Progress in 2010

Objectives for 2010 were shifted to focus on comparison of new ways of adding the primary nutrients and some secondary and micro-nutrients.

One field-scale replicated study was conducted in Potter County on winter wheat using 5 starter fertilizer treatments: The following starter (seed placed) treatments were used:

Number	Treatment	Treatment	Nutrient Applied
1	MAP Alone	11-52-0 at 51 lbs/a	6-27-0
2	MAP plus K	11-52-0 plus 0-0-60	6-27-9(7)
3	MAP plus K and S	Treatment 2 plus 20-0-0-24	11-27-9(7)-6
4	MESZ	Micro Essentials with Zinc	8-26-0-7-1
5	MES	Micro Essentials w/o Zinc	8-26-0-7

The "Nutrient Applied" column gives actual N-P2O5-K2O(Cl)-S-Zn applied in lbs of nutrient/acre in that arrangement. MES and MESZ are uniform pellets containing MAP plus both elemental sulfur and ammonium sulfate as sulfur sources. The MESZ also contains zinc sulfate as the zinc source.

There were 4 replications of each treatment. Each plot consisted of 2 passes the full length of the field (1/2 mile) with a 42-foot JD 1895 air seeder. Urea (122 lbs N/acre) sufficient to produce 62.5 bu/acre of winter wheat was mid-row banded at seeding (SDSU 2.4 lbs N/bu). An additional 30 lbs of N/acre was

applied as 28-0-0 using stream bar techniques at Feekes 6. This brought the yield goal to 75 bu/acre (180 lbs N/acre as fertilizer plus soil nitrate-N). Smokey Hill wheat at 1.1 million PLS was used along with Raxil seed treatment.

The field was sprayed with bromoxynil plus MCPA herbicide. A fungicide was applied at flag leaf emergence.

Plant and soil samples were collected at Feekes 6. The plots were harvested by taking a single 35 foot wide cut from the center of each plot using a standard JD combine. The grain was weighed in a grain cart. Samples were taken from each plot as grain was unloaded. Both the grain and plant samples were analyzed for major and minor elements by Ward Laboratories in Kearney, Nebraska using ICAP (inductively coupled plasma using an argon gas carrier) techniques.

Pre-season soil tests indicated 20 lbs of nitrate-N/acre; 50 lbs of sulfate-S/acre; and 16 lbs of chlorine/acre. This triggers a recommendation of 24 lbs of P2O5/acre as a band. There would also be a recommendation for at least 21 lbs of Cl/acre. Some laboratories would also recommend sulfur at 7 lbs of S/acre in a band.

Potter County Winter Wheat Starter Study 2010						
South Dakota Wheat Commission Funded Project						
Treatment	Yield (bu/a)	Grain Protein	Chlorine at Feekes 6	Sulfur at Feekes 6	Grain Chlorine	Grain Sulfur
MAP Alone	89.9	10.7	0.13	0.27	0.060	0.127
MAP plus K	91.4	11.1	0.38	0.27	0.065	0.130
MAP plus K and S	93.3	10.9	0.34	0.31	0.065	0.130
MESZ	92.1	11.1	0.15	0.27	0.065	0.130
MES	94.9	11.6	0.12	0.27	0.063	0.137

The yields were better than anticipated. This resulted in protein that was lower than desired. An additional 10 gal/acre of 28-0-0 (30 lbs N/acre) at Feekes 6 or later would have brought the protein to acceptable levels. There was a visible early-season growth and color response to the treatments that included sulfur. That is common in long-term no-till because sulfur cycles in the organic fraction. This response was not evident by Feekes 6.

The most dramatic response at the Potter County site was the large difference in plant chlorine concentration at Feekes 6. A small (6 lbs Cl/acre) application of chlorine in proximity to the seed more than doubled plant concentrations at that point in time. This period is when the plant is very vulnerable to leaf diseases. This is especially true when it is seeded into spring wheat stubble. This factor should be investigated further.

A similar study was performed at the Dakota Lakes Research Farm (main station). Only three treatments could be used because of space limitations. Treatments used included MAP alone; MAP plus K plus S; and MES. Alice HWW was the variety used at Dakota Lakes

Dakota Lakes Research Farm Winter Wheat Starter Study 2010						
South Dakota Wheat Commission Funded Project						
Treatment	Yield (bu/a)	Grain Protein	Chlorine at Feekes 6	Sulfur at Feekes 6	Grain Chlorine	Grain Sulfur
MAP Alone	99.2	11.8	0.57	0.29	0.06	0.15
MAP plus K and S	97.3	12.1	0.69	0.27	0.08	0.15
MES	95.2	11.5	0.64	0.30	0.06	0.14

Procedures were similar with the exception that the N (75 lbs of N/a) sufficient for 80 bu/a of wheat was applied at Feekes 6 using stream bar techniques. Yields were again higher than anticipated. Protein was slightly low but not by as much as on the Potter County study. The probable explanation is that this wheat was grown in a Wheat-Corn-Pea rotation. N cycling from organic matter would most likely occur sooner and at a higher level than where spring wheat was the previous crop. There was no response to the addition of sulfur or chloride in either yield or plant concentrations. The chloride levels in the soil are considered sufficient on this field. The soils on the dryland portion of the DLRF main station are derived from inland sea sediments that are high in chlorine. The Potter County soils are derived from glacial till covered by loess. These soils are naturally lower in chlorine.

The Potter County site indicated that the plant samples at Feekes 6 were marginally low in copper. The plant samples at DLRF were marginally low in zinc. Wheat is responsive to copper at times but normally not to zinc. Corn is more responsive to zinc.

A preliminary study in Potter County testing potential copper fertilization options using spring wheat was also conducted in 2010. There were actually two experiments. One with copper seed treatment vs. no seed treatment over 3 replications. The second comparison was between foliar applications of 1.5 pints of 7.5% EDTA copper/acre (0.15 lbs Cu/acre) and no foliar application.

Potter County Spring Wheat Preliminary Copper Studies 2010	
South Dakota Wheat Commission Funded Project	
Seed Treatment Cu	68.6
No Seed Treatment Cu	67.5
No Foliar EDTA Cu	67.4
Foliar EDTA Cu	67.7

Soil test values at this site indicated 0.51 ppm of soil copper in the 6-inch sample. This is considered marginal.

There was not a significant response to copper from either treatment. There may be a response in grain copper. For those feeding livestock this might be important.

As stated in the introduction there will be four projects that will define aspects of wheat production.

The first will evaluate 3 seeding rates for winter wheat into spring wheat stubble. The seeding rates used will be 0.95 million PLS; 1.3 million PLS; and 1.65 PLS. The plants from these replicated treatments will be evaluated for yield components (tillers, spikes, spiklets/spike, kernels/spiklet , kernel weight, etc.). Contemporary wheat production techniques will be used. That includes mid-row banding and stream bar applications.

The second is a follow-up to this year's work on hard-red spring wheat response to foliar and seed placed copper. A more comprehensive sampling protocol will be used. In addition a treatment that looks at broadcast or band application of copper sulfate will be used.

The third study will look at inclusion of sulfate sulfur treatments applied as ammonium sulfate at Feekes 6 compare to using a straight nitrogen source (UAN) at that time. A check and a combination treatment will complete the 4 treatment protocol. Grain analysis will be performed. In addition, grain samples will be submitted to a commercial test laboratory for evaluation of flour quality parameters.

The last area of focus will be a preliminary evaluation of the potential for low rates of chloride fertilizer to impact early season disease pressure. This project is building on the significant difference in leaf tissue chloride concentrations where low rates of starter were used in the 2010 study. A low-testing site will be used. Treatments will be starter chloride (low rate); broadcast chloride (higher rate); and check. Plants will be rated for leaf pressure.