❖Dakota Dirt❖

Volume 13 Issue 2 Spring June 13, 2005

A newsletter from the Soil Testing Laboratory at SDSU
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Lab Notes

The corn is in the ground, up but most not growing quickly yet. It needs heat and the weather man is promising us some. Not all of the soybeans are planted and many fields have emerged. All the rain is a mixed blessing. Some have had too much with delayed planting and preventive planting in some areas. For central and western South Dakota it is a relief for the crops, pastures, and dams. As for nutrients, we have had some wheat come in showing N deficiency. The hard frosts and cold weather earlier slowed the wheat and alfalfa. The wheat however has thrived under the cooler, moist conditions. Many samples have shown some disease problems. Questions are being asked about late N applications for wheat to capture potential protein premiums (see article). Hopefully, the heat will come and move along our warm-season crops as well.

Prepared by Keri Skroch, Carolyn Hoffman, Lisa Ulvestad, Chris Morris, and Ron Gelderman

Micronutrients and Glyphosate - an Unhappy Marriage

The following appeared in the NDSU CROP & PEST REPORT on June 2, 2005.

Soybeans in our region do not respond to most micronutrient applications. Zinc has not been found to increase yield in our area. Iron might make a plant green up on an occasional field, but research has illustrated the inconsistency of any yield response. Manganese has not been shown to be beneficial in our region. However, in Michigan and northern Indiana, manganese responses are common on some soils. In their efforts to combine trips across fields and save time and money, farmers in this area have added manganese and other micronutrients to their glyphosate spray mixture. Odd things started to happen. A researcher at Michigan State (Bernard) has conducted a series of studies on this technique and this is what has been found so far:

1. Control of velvetleaf (a common soybean weed in the mid-west) and lambsquarter control was reduced about 50% with addition of iron and zinc to glyphosate.
2. Control of weeds when metals were applied was increased if the glyphosate rate was increased and/or the ammonium sulfate concentration was increased, but not up to levels without the metal additives.
3. Most manganese formulations reduced weed control. The mechanisms for reduced efficacy varied depending on the source of the metal. Some reduced absorption, while some had no effect on absorption, and the effect was more physiological. This research has been supported by an article from Virginia, where manganese fertilizers reduced the control by glyphosate of several common weed species.

The following are my recommendations:

1. Micronutrients have not been effective in increasing soybean yield in this region, so don't use them.
2. If foliar micronutrients are used, separate the

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glyphosate and micronutrient applications by about 5 days.

Prepared by Dave Franzen, NDSU Extension Soils Specialist

Guidelines for N Applications to increase Wheat Grain Protein

We have had some questions regarding late N applications to increase wheat grain protein levels to capture any protein premiums that may be present this year. The southern wheat harvest has just begun so it is somewhat early to predict if significant premiums will be available this year.

We have done a number of studies with both winter and spring wheat looking at the effects of late N applications on wheat grain protein. We can offer these guidelines.

1. Rate of N – Work in North Dakota looking at foliar N at the rates of 0, 15, 30, 45 or 60 lbs N/a showed that grain protein increased with rate when applied immediately after flowering. However protein increases tended to level off when the application rate was higher than 30 lb N/a. In addition, flag leaf burn proportionally increased with the higher rates. Work in South Dakota with spring wheat using spring soil-applied rates of N showed that producing maximum grain protein took an average of 30 lb N/a more than the rate to produce maximum yield. The actual N needed to raise protein content 1% is only about 6 lb/a at 60 bu/a yield and increases to about 10 lb/a with yields at 100 bu/a (Table 1). Therefore 30 lb/a of N applied post-flower should be sufficient in most cases and limit burning.

Table 1. The influence of wheat grain protein content and yield on grain nitrogen content.

Grain protein	Wheat Yield (bu/a)		
	60	80	100
%	—-lb/a of N in grain—-		
14	88	118	147
15	95	126	158
16	101	135	168

2. Source of N – In general there is urea (dry) or 28% (UAN liquid, ½ urea + ½ ammonium nitrate) that is commonly available. Is one source better than another? There are problems and advantages with both sources. With 28% we run the risk of significant burn of the flag leaf which has been shown to reduce yield. An advantage is that some of the N may be taken up thru the leaf and stem. With dry urea we need to depend on timely rainfall (within two weeks) to dissolve the granules and move the N into the surface soil for root uptake. Four years of comparisons between liquid and dry forms shows a distinct advantage for the liquids for spring wheat (Figure 1). We would conclude that some of the N is taken into the plant directly thru the leaf, stem, or head.

3. Timing of N – Six years of comparisons between applying the foliar N at boot or at post pollination clearly favors the latter timing (Figure 2) for both spring and winter wheat. How late one can apply the nitrogen needs further research. However, the protein in the kernel is generally considered to be laid down first before most of the carbohydrates.

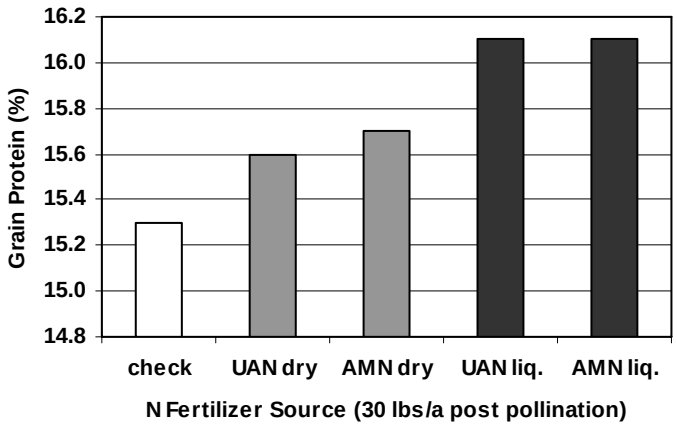

Figure 1. Nitrogen fertilizer source influence on spring wheat grain protein near Brookings, SD during 2001 to 2004.

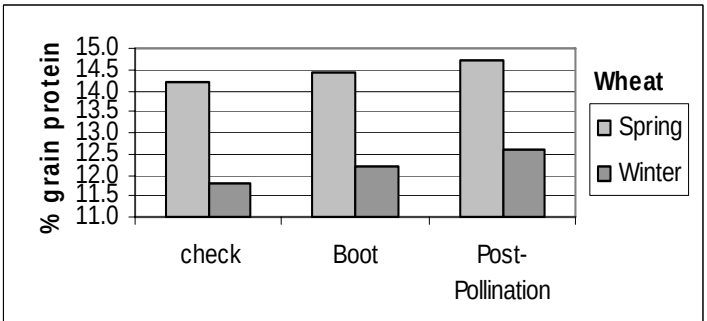

Figure 2. Influence of foiar N application timing on grain protein of wheat from 1995 to 2000 at Brookings, SD.

Therefore, the N should be applied early in kernel development. Application after flowering will eliminate flower abortion from UAN burn. However, application of dry products will not affect flowering, so application of urea could take place from head emergence to post flower.

4. Predicting grain protein response - Our data suggests an average of about 0.75% and 1.00% grain protein increases for spring and winter wheat, respectively when the N is foliar applied just after flowering. We can not accurately predict when we will receive a significant grain protein increase to foliar N, however we can improve our chances. If potential wheat yield at late boot to heading appears to be better than established early season yield goals, then chances of increasing grain protein is about 70%. Conversely, if potential wheat yield is at or below yield goal, the chances of increasing grain protein with foliar N falls to 23%. Plant analysis work shows that average grain protein increases to foliar N go up once total plant nitrate-N drops below 0.1 and 0.2% for winter and spring wheat, respectively. Whole plant samples should be taken at full boot (Feekes stage 9.0).

5. Application guidelines – Foliar application of liquid N can be applied at 30 lb N/a (10 gal/a of 28%) diluted 1:1 with water to 20 GPA. SDSU studies using this approach has never shown a significant problem with leaf burn. Applying the N toward evening or on cool, cloudy days will reduce burn even further. Avoid hot, dry, high light-intensity conditions.

6. Economics – Economics of foliar application will depend on wheat yield, protein increases, protein premiums, fertilizer and application costs. Some protein premiums needed to break even are listed in Table 2 for various yields and grain protein responses. The assumptions are given at the bottom of the table. Each grower can plug in their own costs, assumptions and expected yields and protein increases.

7. Bottom Line – If significant protein premiums exist and potential yields are higher than expected, post-flowering N applications can be highly profitable.

Prepared by Anthony Bly and Ron Gelderman

Table 2. Protein premiums needed to break-even for various expected yields and grain protein responses.

	Expected grain protein response (%)		
Expected yield	0.5	0.75	1.00
bu/a	Dollars premium per point (%) of protein to break even[1]		
60	0.57	0.38	0.28
70	0.49	0.32	0.24
80	0.43	0.28	0.21

[1]Assuming 28% at $1.20 per gallon and application cost at $5.00 /a. Assuming expected protein is over minimum needed. Application field damage was not considered.

Soil Sampling Influences CSP Sign Up

Relatively few farmers were eligible for the Conservation Security Program sign up that ended a couple weeks ago for the Vermillion and Upper Big Sioux watersheds. The primary reason for not being eligible for the program was the lack of soil testing during the last two years. A particular problem was not having the two-foot nitrate test done prior to nitrogen application.

The program requires soil testing during the two years prior to signing up if nitrogen and/or phosphorus were applied. Soil testing includes the 6-inch deep sample for phosphorus and the two-foot sample for nitrate. The standard recommended soil sampling procedure of splitting the two-foot sample into topsoil (0-6 inch depth) and subsoil (6-24 inch) depths fulfills the requirements for sampling.

In addition to soil sampling, SDSU fertilizer recommendations needed to be followed to be eligible for the program. Yield goals used for determining fertilizer recommendations generally need to be based on soil productivity ratings, county average yields or multi peril crop insurance averages plus 10%.

The sign up for those two watersheds has ended and ineligible producers will not be able to sign up again until those watersheds are again designated some time in the future. That may be 8 years or so from now since the current plan is to rotate the sign up between watersheds so that all watersheds have a turn over an eight-year period.

It has not been decided yet which watersheds will be designated for next year or subsequent years. However, if producers want to be eligible for this program when the watershed they farm in is designated, they should start soil testing correctly and applying nutrients according to recommendations now so they have the proper history and records of good nutrient management.
Prepared by Jim Gerwing

Soil Sampling Workshops

Two soil sampling workshops will be offered this fall. They are designed for crop consultants, agronomists, educators, and advisors that are doing soil sampling. The identical programs will be on Tuesday, Sept. 20th at Mitchell and the other will be Wednesday, Sept. 21 at Watertown. The workshops will begin with a free lunch at noon and the program will follow. There will be basic as well as more advanced presentations on soil sampling. A panel of soil samplers will offer their experiences, methods, and suggestions. CSP sampling rules will be discussed and equipment vendors will be present. Sponsors include the SD Dept. of Ag., The SD independent Crop Consultants Association, the SD NRCS, and SDSU. Stay tuned for additional details in Dakota Dirt.
Prepared by Ron Gelderman and Jim Gerwing

Plant Sampling

We are in the midst of plant sampling season. With the cool spring and wet soil conditions, there are some abnormal looking plants in our fields. Plant samples can be very helpful 'problem solvers' when symptoms are noted in the field. If a few things are considered, a diagnosis of the problem becomes much easier. Some things to consider are:

1) What are the symptoms? Note where the symptoms are on the plant (top leaves, lower leaves, stalk, etc.). 2) Describe the symptoms, i.e. spots, stripes and the color of the symptom. 3) Note if roots are normal. 4) note any patterns in the field, i.e. uniform across the field, if occurs on hill tops or lower ground. 5) Watch for application, tillage, and/or planter patterns.

Take a plant sample from affected areas and non-affected areas. A soil sample from both good and poor areas can also help diagnosis. Consider a 0-6 and 6-24 inch samples if N, S, or Cl deficiency is suspected.

For corn take 20-25 whole plant samples when less than 12 inches tall. For small grain from jointing stage and later, 25-50 will be sufficient. For soybean or alfalfa, 40-50 plants will do.

If you would like us to look at the symptoms, either bring in the plants or ship with some soil intact on the roots and ship in a cardboard container. If just for analysis ship in a paper or cardboard container. We can either mail, fax, email, or call you with the results, usually within 3 days after we receive them.
Prepared by Ron Gelderman

What's Happening

Date	Event	Time
June 21	ARS Research Farm Field Day	Brookings, 6:00 pm
June 27	Brookings Field Tour	5:00 pm
June 28	SE Farm Field Tour	3:00 pm
June 29	Highmore Field Tour	3:00 pm
June 30	Dakota Lakes Field Tour	10:00 am
July 7	NE Farm Field Tour	4:00 pm
July 19	Permit Manure Training	Crossroads, Huron 8:30 am
Sept. 20	Soil Sampling Workshop	Mitchell
Sept. 21	Soil Sampling Workshop	Watertown
Feb 1-2 2006	Midwest Conservation Tillage Conference	Ramkota, Sioux Falls

Research Progress Reports Available

Each year progress reports are written on soil fertility and other soil and water research projects. On the following page is a list of the 2004 reports. It would be difficult for us to send them to everyone, but if you have a particular interest in one or a few, let us know and we'll get them to you. They will also be available very soon on the internet at http://plantsci.sdstate.edu/soilreports/. Internet links will be supplied at our lab site (see newsletter heading) and from the Plant Science department page. These reports can be printed off exactly as they appear on the printed reports. All reports will also be available on CD at a cost of $5.00. Let us know what you need.

2004 PROGRESS REPORTS

SOIL PR 04-1	Fertilizer Potassium, Sulfur, Zinc, Phosphorus, Boron and Lime Effects on Corn Yield on High Testing Soil
SOIL PR 04-2	Fertilizer and Soil Test Effects on Wheat Yield, Highmore, SD, 2004
SOIL PR 04-3	Fertilizer Influences on Soil Test and Soybean Yield, Watertown, SD 2004
SOIL PR 04-4	Nitrogen Management in a Corn Soybean Rotation
SOIL PR 04-5	Nitrogen Application Timing Influence on Corn Grain Yield and Residual Soil Nitrate-N at Beresford SD in 2004
SOIL PR 04-6	Foliar Nutrient Application Influence on Soybean Yield at Aurora and Beresford SD in 2004
SOIL PR 04-7	Fertilizer N and P Influence on Pasture Yield in McPherson County SD in 2004
SOIL PR 04-8	Nitrogen Rate and Sulfur Influence on Corn Yields, Watertown and Aurora, 2004
SOIL PR 04-9	Sulfur and Chloride Applications for Corn
SOIL PR 04-10	Long-Term Phosphorus Management for No-Till Corn and Soybean in the Northern Cornbelt
SOIL PR 04-11	Long Term Nitrogen and Organic P Applications to Grass
SOIL PR 04-12	Response of Corn and Soybean to Soil Test K and Tillage
SOIL PR 04-13	Influence of Gypsum on Crop Yields
SOIL PR 04-14	Crop Nutrient Management using Manure from Rations containing Distillers Grain
SOIL PR 04-15	A Summary of Soil Test Results (July 2003-June 2004)
SOIL PR 04-16	How Near to the Corn Row Can Nitrogen Fertilizer be Safely Placed?
SOIL PR 04-17	How Far Can Banded Phosphorus Fertilizer be Placed From the Corn Row?
SOIL PR 04-18	Fertilizer Value of Dried Distiller Grain and Solubles (DDGS) Ash
SOIL PR 04-19	Temperature of Extraction Influence on Nitrate-N, Olsen Phosphorus, Potassium, and Zinc Soil Tests.
SOIL PR 04-20	Influence of Tillage Method and Previous Crop on Soil Temperature, Emergence, Plant Population, Growth, and Yield for Corn at the Southeast Research Farm in 2004
SOIL PR 04-21	Zone-Till Influence on Corn Grain Yield at Brookings SD in 2004
SOIL PR 04-22	Nitrogen Application Timing and Rate Influence on Hard Red Spring Wheat Grain Protein and Yield near Aurora, SD in 2004
SOIL PR 04-23	Comparison of Liquid and Dry Nitrogen Fertilizer Materials Influence on Grain Protein and Yield of Hard Red Spring Wheat at Aurora SD in 2004
SOIL PR 04-24	Managing Cultural Practices for High Yield Wheat at Brookings SD in 2004
SOIL PR 04-25	Influence of Iron Fertilizer Application, N Rate, Timing of Plant Thinning, Row Spacing and Seeding Rate on Iron Chlorosis Deficiency (ICD) Symptoms of Soybean at Brookings SD in 2004
SOIL PR 04-26	Corn Grain Yield Response to Sulfur Application.
SOIL PR 04-27	Urea N Application Timing for No-Till Corn Near Aurora SD in 2004
SOIL PR 04-28	Lime Application Effects on Corn and Soybean Grain Yield and Soil pH at Aurora SD in 2004
SOIL PR 04-29	Crop Rotation, Tillage Method, and Crop Residue Management Study at Brookings SD
SOIL PR 04-30	Nitrogen Application Timing and Rate Influence on Nitrate-Nitrogen Leaching and Corn Grain Yield near Aurora SD during 2004
SOIL PR 04-31	N Fertilizer Rate Influence on Corn Hybrid Grain Yields at Beresford, SD in 2004
SOIL PR 04-32	N Fertilizer Rate Influence on Corn Hybrid Grain Yields at Brookings, SD in 2004
SOIL PR 04-33	Influence of Conservation Tillage Methods and Fertilizer Application on Corn Growth and Yield at Brookings, SD, in 2004
SOIL PR 04-34	Foliar Fertilizer Influence on Corn Yield at Brookings SD in 2004
SOIL PR 04-35	Fertilizer Application Influence on Alfalfa Dry Matter Yield in Brookings County, SD during 2004.
SOIL PR 04-36	Effect of Azospirillum, N Sources, and Nitrification and Urease Inhibitors on Corn Growth in Two Soils with Different pH
SOIL PR 04-37	The Influence of VAM Mycorrhizae Fungi, Phosphorus Solubilizing Bacteria, and Two P Sources on the Growth and P uptake of Corn
SOIL PR 04-38	Corn Emergence Following Fall and Spring Cover Crops
SOIL PR 04-39	Starter Fertilizer Improves Corn Yield
SOIL PR 04-40	Soil Penetrometer Resistance and Corn Yield Under Tilled and No-Till Soil Management
SOIL PR 04-41	Evaluating Soil Test Phosphorus Thresholds for South Dakota Soils
SOIL PR 04-42	Nutrient Management within Soil Erosion Zones