University of Idaho
Cooperative Extension System

The Cereal Sentinel

A newsletter for Treasure Valley cereal producers

May 14, 2007 Issue No. 45

Topics: **Page**

Reminders

Parma R & E Center Small Grains Tour **July 6, 2007**

In addition to variety performance we will show N fertilization trials testing slow release N fertilizers for winter and spring wheat, inter and relay cropping of oil seed crops in small grains.

Malheur Station Field Day **July 11, 2007**

The goal of this newsletter is to serve the best interests of Treasure Valley cereal producers. It will be issued periodically as information warrants. Correspondence and inquiries should be addressed to:

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Pests

Cereal Leaf Beetle

Cereal Leaf beetle (CLB) adults were evident April 4 in winter barley at Parma, and feeding was evident in oats the following week. Adult feeding occurs through the entire leaf in short lengths (1/4 to 1 inch) along a vein in a narrow strip (about 1mm wide) and is typically inconsequential in terms of damage to the plant. Egg laying was evident by the third week in April, and larvae were seen April 26.

Scouting is essential to determine if egg and or larvae populations are high enough to warrant control. The economic threshold is three larvae or eggs per plant before boot stage and one larvae per flag leaf after boot stage. If you suspect from CLB egg numbers that control will be necessary, make sure it is the larvae that you're treating rather than the eggs or adults. That means waiting for larvae emergence. Check the label in all cases.

Biological Control

Ben Simko, Idaho Department of Agriculture (ISDA), released ***Anaphes flavipes***, a tiny egg parasitic wasp in spring 2004 and 2005. Unfortunately, this egg parasitoid has not successfully over wintered and become established to date in our nursery.

However, about 50% of the larvae collected in 2005 at Parma were parasitized with ***Tetrastichus julis***, the larval biocontrol agent released in previous years by Mike Cooper (ISDA). Practically all collected larvae were parasitized by the end of the season in 2006. It appears to be established and providing effective control where we have not attempted to control CLB with insecticides. With similar results this year, Ben will use our host plantings of oats as a source of parasitoids to release in other areas of the state where the CLB is developing.

Where the CLB is repeatedly controlled chemically, CLB biocontrol agents don't have hosts for their reproduction. The likelihood of successful biocontrol establishment with this scenario is low. Repeated spray for control of CLB regardless of the numbers present works against establishment of biocontrol agents.

With the higher price for grain this year, many will be tempted to control CLB even though egg or larval numbers are well below the economic thresholds of three eggs or larvae per plant before boot stage or one larvae per flag leaf after boot. These prophylactic applications are likely not cost effective and preclude parasitoid spread and establishment.

Barley Trait Response to N

Barley fractionation in the TVRR Inc. facility has potential for increasing the value of locally grown barley, the production acreage and rural income from barley. Beta-glucan soluble fiber will be marketed into high value food channels as an effective cholesterol reducing - heart disease preventing food ingredient, as indicated by the recent USDA Food and Drug Administration announcement. Other bran fractions may have food value as well.

Food grade starch can also be isolated and marketed for higher value. The company plans to use the residual starch, that which can't be sold into food channels, for producing ethanol. This venture has the potential for vastly changing the small grain complexion of the Treasure Valley.

The fractionation enterprise will also be capable of isolating and concentrating grain protein that can be used in a nationally recognized aquaculture industry in southern Idaho currently dependent primarily on expensive fish protein. The TVRR Inc. consortium plans to pay a premium for higher protein barley.

High protein barley historically is avoided for malting and is seldom sought out by the feed industry because of its association with low test weight barley from rainfed production. A market for high protein but plump barley is somewhat of a novelty.

USDA-ARS breeding programs as well as others have focused for the most part on developing acceptable malting barley. Since high protein malt barley is unacceptable to brewers, there has been little attempt by barley breeders to develop high protein varieties.

Since high protein barley was historically avoided, there is limited information on the barley protein response to cultural practices such as nitrogen management, known to affect protein of similar grains such as hard wheats used for breadmaking. We have extensive information and local research on the protein response of hard wheats to N management. Much of this information is likely pertinent to enhancing barley protein.

Since the local fractionation enterprise will market several value added components of the grain, and contract prices will reflect the income from marketing various fractions, it is important to know how the relative components are affected by N management

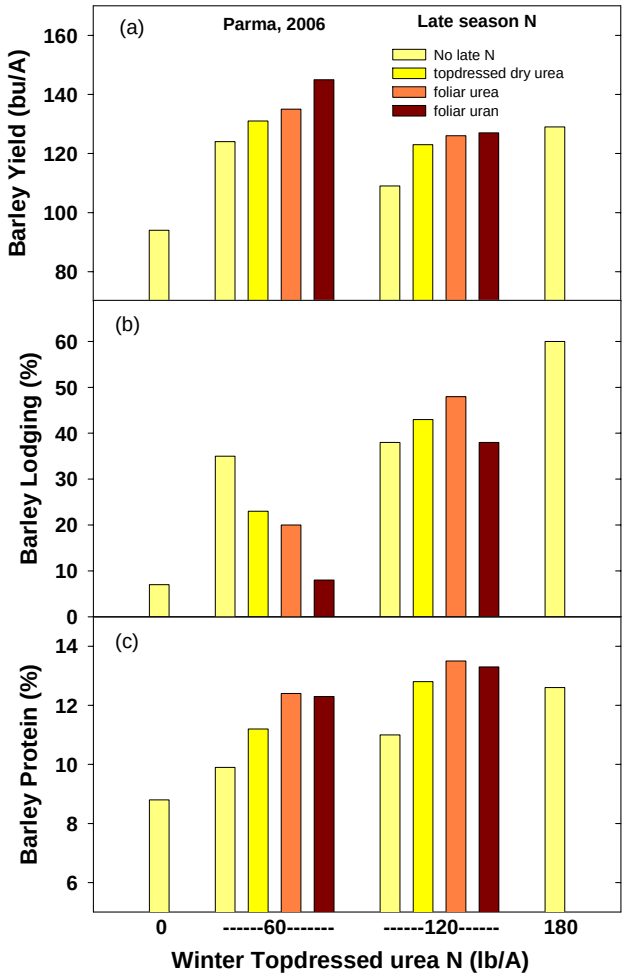

Figure 1. Barley yield , lodging, and protein as affected by late winter topdressed N and late season N treatments.

practices, especially for the irrigated waxy barley that will be used for fractionation. A grant from the federal **Barley for Rural Development Initiative** enabled us to examine N management effects on waxy barley value added traits.

Parma Study

A field study was conducted in 2006 involving two fall planted spring two row waxy barley genotypes (hulled Salute and hulless Merlin) grown with four winter top-dressed N rates (0, 60, 120, and 180 lb/A). At the 60 and 120 N rates, late season N was applied at 0 or 40 lb/A with the N applied as either (1) dry urea, (2) foliar urea solution, or (3) foliar urea-ammonium nitrate (uran).

There was significant winter kill of these fall planted spring genotypes. Winterkill of Merlin and Salute averaged 29 and 18% at Parma. Yields were likely limited by stand reduction but yield at Parma was still better than expected, reaching as high as 145 bu/A for Merlin and almost 130 bu/A for Salute.

Winter topdressed N increased grain yield and protein (Fig 1a and 1c). Optimal winter N for yield following beans was 60 lb N/A if no late season N was applied. Higher winter N rates tended to reduce yield at Parma possibly due to lodging (Fig. 1b). Protein continued to increase with N applied at the highest N rate. Varieties did not differ in their response to winter topdressed N.

Late season N (40 lb/A) increased yield and protein at Parma at both the 60 and 120 lb topdress N rate. Foliar N at heading tended to be more effective than

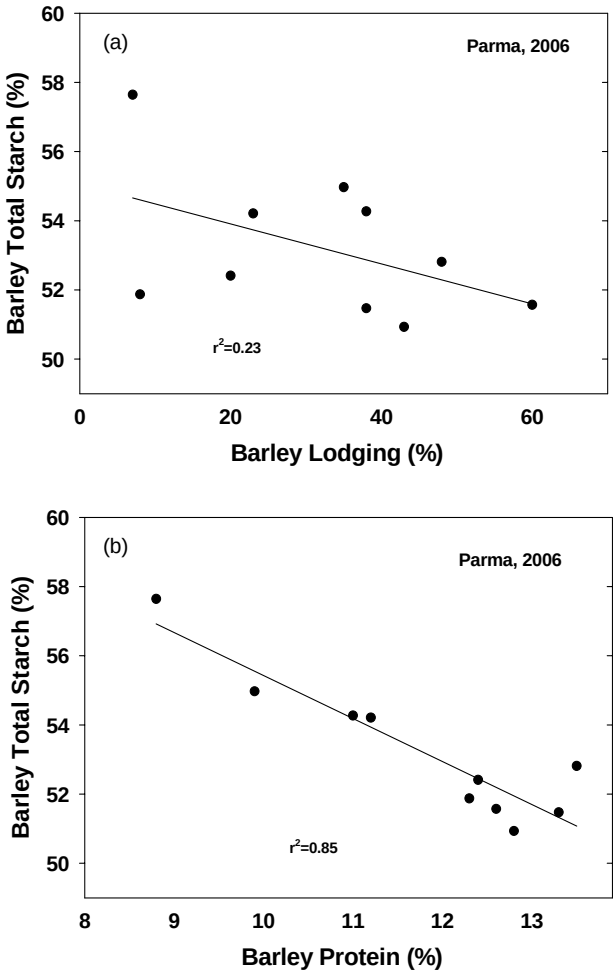

Figure 2. Barley total starch as related to lodging (a) and protein (b) at Parma.

topdressed dry urea. Apparently the application of only 60 lb preplant N enabled this fall planted barley to avoid excessive vegetative growth that contributed to lodging. Controlling early season growth and lodging of these barley varieties appears to be essential for maximizing grain yield. This places more emphasis on providing late season N for grain filling.

Winter topdressed N did not affect test weight appreciably despite the greater lodging with higher N (data not shown). Late season applied dry urea reduced test weight at Parma while foliar urea N had little effect.

Total starch content was also measured in the harvested grain samples by Dr. Kerry Huber in Moscow. Starch content decreased as the late winter N rate increased. Starch content was likely reduced due to lodging at higher N rates as reduced light penetration reduced photosynthate available for grain filling (Fig. 2a). Starch content and test weight were poorly correlated in this study.

Lower starch was also due to higher protein (Fig. 2b). Starch content was more closely related to protein than it was to lodging, or test weight. The late season N affect on starch content was mixed, but generally starch decreased as late season N increased protein above 12%.

The results suggest that N essential for increasing harvested protein may reduce harvestable starch. It is not clear whether the starch reduction with N was food or non-food grade starch. The tradeoff between protein and starch content in barley is well known, but is often attributed to the effects of shriveled kernels due to lodging or moisture stress.

Beta-glucan will also be determined on these harvested samples from Parma, but the results are not yet available. Beta-glucan from a comparable trial at the Malheur Experiment Station conducted by Dr. Steve Norberg and Clint Shock indicated that Beta-glucan was most affected by late season N applied with Ethephon. Additional research is needed to verify these results.

Triticale Forage P Uptake and N

Last year I reported (***The Cereal Sentinel*** Issue 42) the boot stage triticale forage production results from preplant incorporated and winter topdressed N at low and high available P. Briefly, preplant N consistently increased forage biomass more than late winter topdressed urea, consistent with our understanding that preplant N promotes vegetative growth more than it does grain yield. For example, historically, the lower efficiency of early fall N in irrigated winter wheat was attributed in part to excessive vegetative growth.

While greater vegetative growth may be detrimental for the production of grain, it is essential for maximizing forage production and phosphorus (P) removal. The P analysis of forages has been completed and those results are reported here.

Optimum N for forage production was 180 lb N/A, regardless of available P. Unlike forage production that did not increase with N applied above the 180 lb N/A rate, P removal was highest at the 240 N rate where

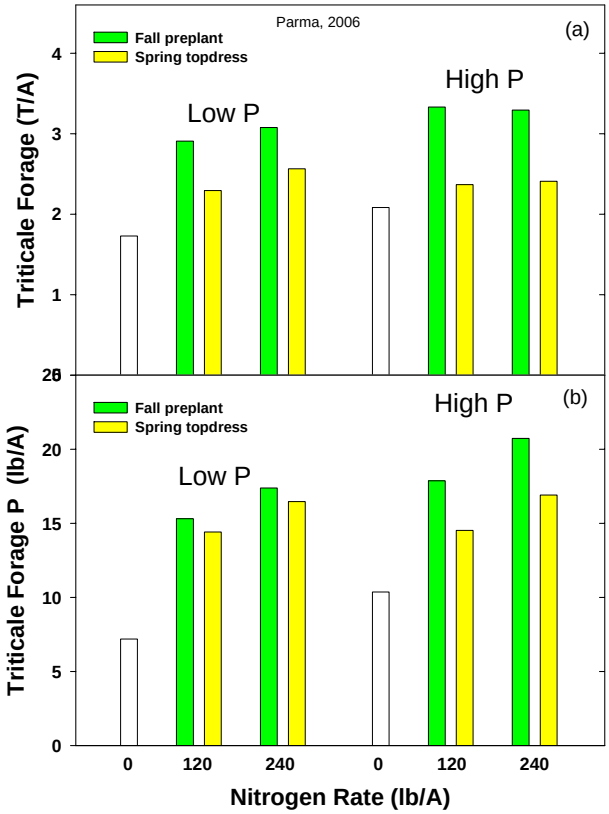

Figure 3. Boot stage winter triticale forage and P content as affected by N rate and timing of application. Parma, 2006.

higher P was available (Fig. 3a and 3b). Maximizing P removal under high P conditions appears to require more N than is required for maximizing forage production. Increased P uptake with higher N was due primarily to increased forage P concentrations. The importance of N in maximizing P uptake has been reported for other forages.

The timing of N application may not have been as critical for P removal as for forage production under limited P conditions. But with high P, fall preplant N resulted in higher P removal than with late winter

topdressed N. The greater P uptake with fall preplant N was due primarily to increased forage production rather than higher forage P concentrations.

One other objective of the study was to determine the protein concentration relative to maximum forage production. Relative forage yield (percent of maximum) is related to protein concentrations in Figure 4. Maximum forage yield was associated with a minimum of 10% forage protein regardless of the available P present. Protein increased beyond 10% with N rates of 240 lb/A or above but forage yields peaked between 10 and 11% protein.

Triticale can accumulate excessive nitrates under some stress conditions with high available N. Triticale forage nitrates measured in this study did not accumulate to dangerous levels, even with 120 lb more N than necessary for maximizing yield, because the forage was not drought stressed at harvest.

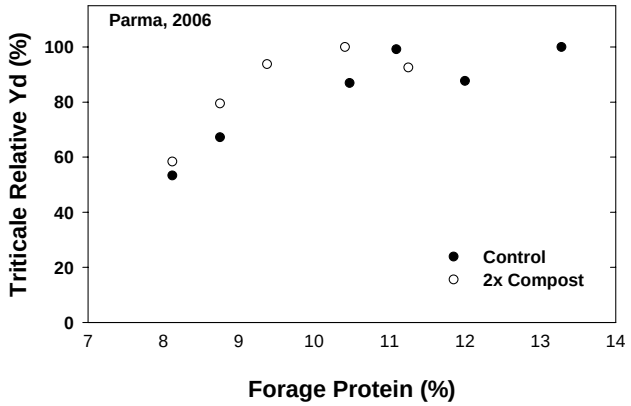

Figure 4. Boot stage triticale forage relative yield (% of maximum) as related forage protein

High Nitrogen Prices

Nitrogen fertilizer prices are at an all time high. With such high N prices growers would be tempted to reduce their N rates somewhat, for soft wheat especially, if it weren't for such favorable wheat prices.

Manure N

Since fertilizer N is so high, and possibly difficult to source, producers may consider alternative N sources that they wouldn't ordinarily use, such as manure. Manure can be an effective N source but it is fraught with some uncertainty. There are general guidelines and a useful publication is PNW 0533, "***Fertilizing with Manure***." It is available on-line at http://cru.cahe.wsu.edu/CEPublications/pnw0533/pnw0533.pdf. It can be downloaded or a hard copy purchased from:

Extension Publications
P.O. Box 645912
Washington State University
Pullman, WA 99164-5912
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Flag leaf N

Plant analysis is used for indicating wheat N status but procedures for plant analysis from boot stage and later are less commonly used for determining N sufficiency for yield. Flag leaves are collected for predicting protein in hard wheat classes and can be used for predicting the need for late season N to boost protein.

To the extent that flag leaves can predict protein they can also be used to determine if N will limit yield. We have measured flag leaf N in several studies as it relates to available N and yield. For hard red winter wheat the sufficiency range in flag leaf total N concentration for maximizing yield appears to be between 3.5 and 4% N (Fig. 5). It turns out the same sufficiency range for yield can probably be used for hard spring wheat as well. This sufficiency range may be adequate for yield but is likely inadequate for acceptable HRWW protein. That is a different question.

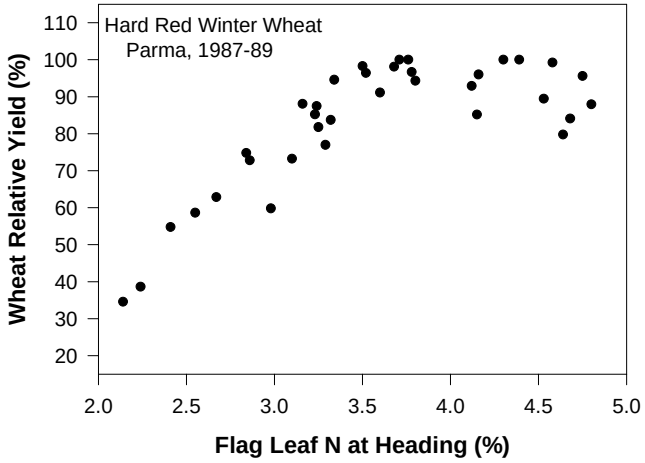

Figure 5. Wheat relative yield as affected by total N concentrations of flag leaves collected at heading.

Chlorophyll Meters

If you don't want to collect leaf tissues for analysis, leaf chlorophyll readings can be useful. The chlorophyll meter is a hand held device that, as the name suggests, allows you to measure the chlorophyll content. Since chlorophyll content is directly related to total leaf N content, the measure provides the means to quickly determine whether N content is limiting to yield.

To show the relation of SPAD values to yield the results from an earlier study are used where residual soil N was very low. Figure 6a shows the percent of maximum yield (relative yield) as it increased with topdressed N. Figure 6b, just below it, shows the increase in SPAD values with the same topdressed N. The response curves for relative yield and SPAD values are very similar.

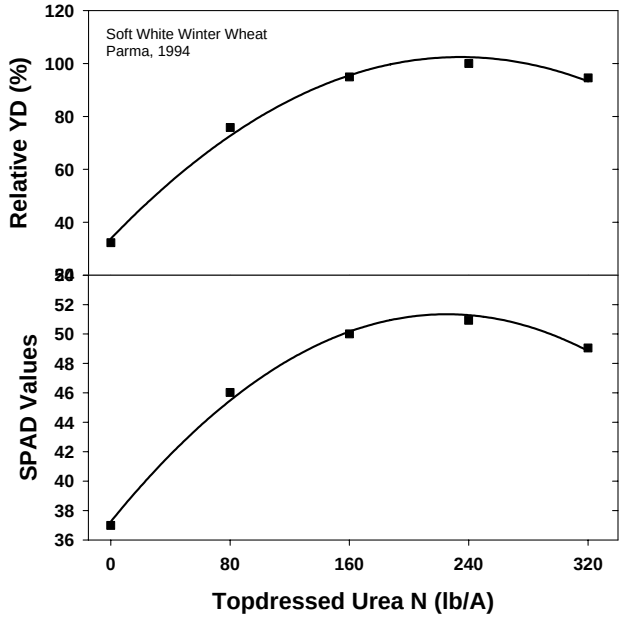

Figure 6. Relative wheat yield (a) and Chlorophyll meter SPAD readings at heading (b) as related to topdressed urea N.

If SPAD values from 1994 are related to relative yield (Figure 7a) the relation shows relative yield increasing linearly (straight line) as the SPAD values increase to about 52. The relation likely differs for every different set of conditions (seasons, varieties, management) so typically the results for several years are combined and viewed together.

If SPAD values from similar trials in the two following years are included, the results appear in Figure

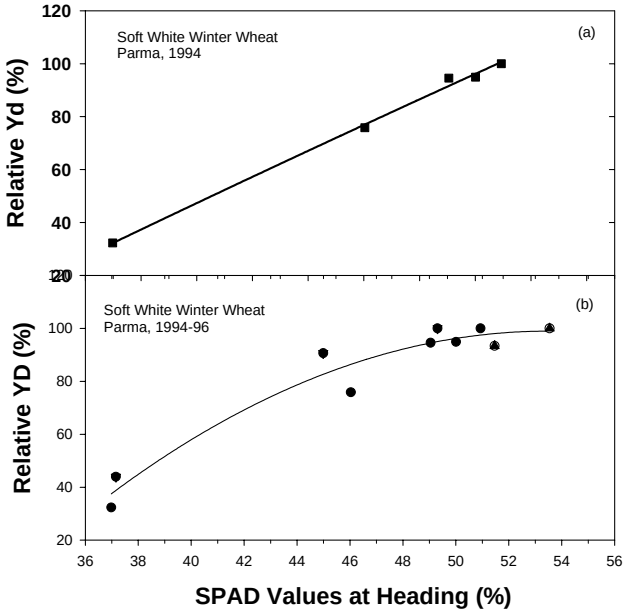

Figure 7. Wheat relative yield as related to flag leaf Chlorophyll meter SPAD readings in 1994 (a) and over the 1994-96 period from three trials.

7b and the relation for all the values is curvi-linear. The results from this group of trials suggests that optimal yields can be expected as long as SPAD values are above 49. We have found that values in excess of 52 are sometimes related to greater lodging.

Grain Protein

At the end of the season, assay the adequacy of N for wheat by reviewing the protein reported for the harvested wheat. All elevators collect a sample of delivered wheat for an assessment of grade. The tests performed for this sample include protein, if requested, for a minimal cost.

The protein (corrected to 12% water) and relative yield from the same data set used earlier (1994-96) are used to show the relation of protein to relative yields (Figure 8). Note in the figure that relative yield tends to increase and peak at 100% as grain protein increases to about 9.0-10% (dark symbols). Protein below 9% in harvested SWW wheat was more likely limited by inadequate available N.

Conversely, there was practically as much risk of lower yields with protein above 10%, certainly above 11%, as there is for low protein. Note the trend in the figure for yields to decline with protein above 10%

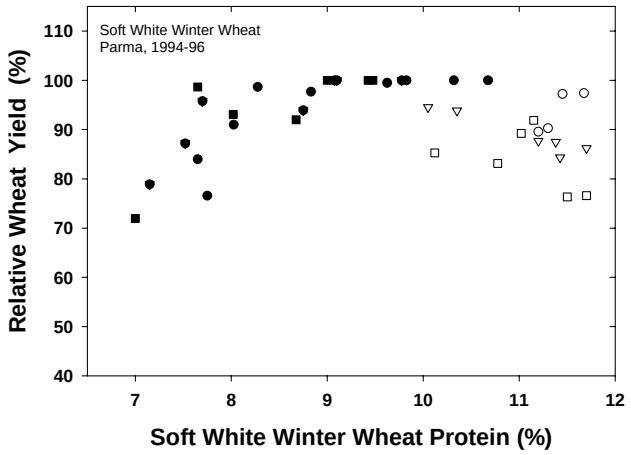

Figure 8. Soft white winter wheat relative yield relation to harvested wheat protein for the years 1994-96 at Parma

(white symbols). The lower yield with higher protein is due primarily to lodging, but not always. Yields can be reduced with excessive N without lodging as I've discussed in previous newsletters.

The protein relation to relative yields are somewhat variety dependent. It is one reason why there is the scatter of points below 9% and above 10% protein. Results in figure 8 are for the varieties Stephens, Malcolm, and Macvicar. Stephens tends to be 0.3-0.7% higher in protein than the others. Consequently yields for Stephens peak at a higher protein than the other varieties. Malcolm and Macvicar are similar in protein and appear to be more sensitive to protein above 10%.

Other factors can influence the relative yield - protein relation. Seasons that differ in disease, temperatures during grainfill, and no doubt other factors can make interpretation of the protein values difficult. Evenso, protein can be a useful assay of available N for the conditions that were present.

New Publications

Urea Management

As most know, major providers of ammonium nitrate fertilizer will no longer be marketing the fertilizer in the future and the primary dry N sources available will be urea (46-0-0) and ammonium sulfate (21-0-0). Urea is the cheapest and is widely used.

While urea can be an effective N source it does involve some risks. The material hydrolyzes (breaks down, or is changed) in the presence of moisture and the urease enzyme to NH_3. When the NH_3 concentration in soil water reaches a saturation point for the conditions present, some will escape to the atmosphere.

When fully incorporated this process is not much different from widely dispersed aqua ammonia, or if sidedressed may not be any worse than banded ammonia. However if the gaseous NH_3 in the soil atmosphere (the air in the free space or voids between soil particles) is high enough, it can be toxic to germinating seeds and seedlings. It's why only so much urea N (typically less than 10 lb N/A) can be placed with seed without reducing the percentage of seeds that emerge.

If urea is not fully incorporated into soil, the other risk is NH_3 volatilization and escape from the soil's surface. This escape represents N lost from the system. It is the most common reason why topdressed urea fails to perform under some conditions as well as topdressed ammonium nitrate.

Despite the potential for NH_3 volatilization from topdressed urea, our research on a silt loam at the Parma R & E Center indicates that winter topdressed urea is as effective as topdressed ammonium nitrate for winter wheat, winter barley, and spring wheat.

The effectiveness of winter topdressed urea N is probably due to more adequate precipitation for incorporation and cooler temperatures. There may be other more obscure reasons as well.

Since volatile NH_3 losses from topdressed urea can be an issue under some conditions and soils, several regional faculty led by Clain Jones at MSU have prepared an Extension bulletin describing in detail the conditions leading to volatile N losses from urea and the appropriate management considerations. The bulletin "**Management of Urea Fertilizer to Minimize Volatilization**," Montana State Univ. Extension Bulletin EB 173, is available free on-line at http://www.montana.edu/wwwpb/pubs/EB0173.pdf. Hard copies may also be purchased from

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Energy and Fertilizer Costs

Last spring a number of the UI Extension faculty involved with small grains were requested to list energy

and cost saving measures that producers might consider. The publication is now available on-line as a UI Current Information Series publication. The title is **Saving Energy and Fertilizer Costs. CIS 1127**. The publication is available on-line at http://info.ag.uidaho.edu/pdf/CIS/CIS1127.pdf. We hope you find something of value in the publication.

Another publication some may find of value is a fact sheet published by Oregon State University pertaining to the N requirements for hard wheat. The publication "**Managing N for Yield and Protein in Hard Wheat**", **FS 335**, is also available online at http://extension.oregonstate.edu/catalog/pdf/fs/fs335.pdf.

Acknowledgement

The **Idaho Wheat Commission** has awarded a grant of $3600 to subsidize this newsletter. We are pleased to acknowledge their support for this Cooperative Extension educational project.

Southwest Idaho Extension Cereals Website

Previous issues of the ***Cereal Sentinel*** newsletter back to 1996 can be viewed as PDF files on the Southwest Idaho Extension Cereals Homepage at http://www.ag.uidaho.edu/swidaho. If you would like to receive electronic notice of new ***Cereal Sentinel*** newsletters posted to the website, rather than the hard copy through the mail, send an e-mail message to me at bradb@uidaho.edu. The advantage for us is that we don't need to produce a hard copy and put it in the mail to you. The website is still under development but the content is considerably expanded from the initial website published in June 2000. In addition to the ***Cereal Sentinel*** newsletters, variety descriptions and performance have been added as well as other topics. If you have suggestions for the website send them to me at bradb@uidaho.edu.

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