MINNESOTA

CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 26 **December 8, 2000**

In this Issue

Final Issue of Minnesota Crop News

Mike Schmitt
Associate Dean-Extension

This is the final issue of the Minnesota Crop Newsletter. This newsletter was created by the University of Minnesota Extension Service's Crops System Specialization group several years ago. Its objective was to provide timely information and education to a diversified audience on numerous crop/plant related issues. Over the years, hundreds of articles were written by scores of Extension Specialists, Extension Educators, and other University personnel. I firmly believe the newsletter was a success in terms of its objective.

Extension has now changed its structure such that there is no longer a Crops System Specialization. The majority of the people are now part of the Agriculture, Food, and Environment Capacity Area. This Capacity Area is expanding its efforts to be inclusive of broader food production issues as well as its efforts in agricultural production systems. Therefore, the decision was made to cease the MN Crop Newsletter. However, Capacity Area leadership will be actively looking at ways to educate and communicate their messages in effective methods in the near future. Thus, we will be keeping the current mailing lists for possible future use.

There are too many contributors to acknowledge individually in this space. However, there are two people who worked relentlessly and often under constant deadlines on this newsletter since its beginning. Special appreciation is directed to Judy Martens (from Soil, Water, and Climate) and Debra Baden Drange (from Plant Pathology) for their "behind the scenes" efforts. Their efforts certainly made this newsletter successful.

2001 RESEARCH UPDATE FOR AG PROFESSIONALS

Kevin Cavanaugh, Dept. of Agronomy and Plant Genetics

The tenth annual Research Update for Ag Professionals (formerly called Ag Professional Update) has been scheduled for January 11-12 and 16-18, 2001. This program is designed for agricultural chemical and fertilizer dealers, crop consultants, agriculture chemical/seed company agronomists and sales people, vo-tech instructors, extension educators, and agricultural government agency people. This four-hour program will provide research update in the areas of nutrient management, crop production and pest management. A total of 3.5 CEU have been applied for all locations, except Morris where 2.5 CEU will be offered. Preregistration and on-site registration will be $40, but all attendees are strongly encouraged to register early so as to avoid delaying the start of the program. The fee includes coffee, refreshment break, and HO materials. To request a brochure that includes locations, starting times, and a registration form, contact Tracey Benson at (612) 624-3708 or 800-367-5363. To view the program, register online or download a copy of the brochure, visit the Internet site at http://www.conferences.umn.edu/mn/crops.

RESEARCH UPDATE LOCATIONS FOR 2001

DATE	LOCATION	START TIME
January 11, 2001	Lake Crystal, American Legion	12:30 pm
January 12	Kasson, Diggers Bar & Grill	12:30 pm
January 16	Crookston, ROC	12:30 pm
January 17	Morris, ROC	8:30 am
January 17	Lamberton, ROC	12:30 pm
January 18	Willmar, Holiday Inn	8:30 am

Cost of Owning and Operating Farm Machinery

William F. Lazarus, Associate Professor and Extension Economist

The extension publication "Minnesota Farm Machinery Economic Cost Estimates for (year)" has been around in its present form since at least 1981. It helps answer a range of questions. Negotiating custom rates, setting up machinery sharing arrangements, making purchase decisions, and developing crop enterprise budgets are some of the more common uses of the publication.

The publication includes a short discussion of the importance of understanding what it costs to own and operate farm machinery, and the assumptions and formulas used to estimate expected costs under specified conditions for an extensive list of tractors, combines, and implements. Two followup questions that users of that publication sometimes ask are: 1) what are the costs for a type or size of machine that is different from those on the list, and 2) how are the numbers calculated? To help answer such questions, a companion Excel spreadsheet template MACHDATA.XLS is available for downloading from the Applied Economics department web page, at: http://apec.umn.edu/crop.html.

The template has a section where users are able to describe the situation under which a power unit and implement will operate and calculate the cost information for that situation. Two situations can be compared if desired. Pull-type forage harvesters are a bit unique in that they may operate at different

performance rates per acre depending on whether they are doing corn with a row crop head or doing a wider swath of haylage with a pickup head. So, there is a separate section in the template just for forage harvesters. The template also contains a database with all of the data describing the conditions on which the costs in the publication are based.

The costs in the publication are based on new equipment prices, but the template also allows costs to be calculated for used equipment. Formulas predict trade-in values and repair costs as functions of the current list price for the machine. For a new machine, the user enters a purchase price and an estimate of what percentage of list that purchase price represents. Purchase prices are often assumed to be 85 to 90 percent of list. Some important considerations for used equipment are that costs are averaged over the years of ownership. For a used machine, the approach taken is to calculate the costs for an average of the remaining years of ownership, starting with an initial used purchase price or value that is typically lower than what a new machine would cost today. When the user indicates that the machine already has some age on it and the purchase price is a lower percentage of today's list price, the trade-in value declines at a lower rate over the remaining life. Repairs accumulate at a faster rate as the machine ages, so the tradeoff between ownership costs and repairs can be explored. The template does not directly factor in the cost of downtime as the older machine becomes less reliable, but that would be another important factor to consider.

Getting More for What you Grow: Be Better, First, or Different

Zachary Fore, U of M Extension Cropping Systems Specialist

There is a simple formula for success in agriculture: Yield x Price - Expenses = Profit. It means growing as much of a product as you can (Yield), paying only for inputs that will return more than they cost (Expenses), and then getting as much as you can for what you grow (Price). Simple, but definitely not easy. How can we tilt this equation in our favor? For your farm to be successful, each enterprise must be at least one of the following: first, better, or different compared to your competition. Which one you choose is up to you. Let's deal with each one separately to help you decide which one you will focus on to be successful.

Better Better means that you are the most efficient producer - on a cost per bushel or cost per unit basis, you are the cheapest. To be better you have to constantly focus on increasing production and decreasing expenses. Most producers currently fall into this category. Producers of undifferentiated commodities such as wheat, corn, soybeans, canola, etc. fall into this category. In recent years it has been very difficult to be profitable using the 'better' philosophy. Prices have been low and production in many areas has been low due to unfavorable environmental conditions and other factors. There has been some opportunity to get a price better than the loan rate by carefully using the LDP and other marketing tactics, but the average gains are relatively low.

First: Often, the first to produce a product can receive a price premium. A few examples are high oil corn, waxy corn, and clear hylum edible soybeans. (Jeruselam artichoke comes to mind here, but that is really not the kind of example I am looking for). You likely can think of other examples. These products often have a price premium early, which decreases with time. Therefore, if you are not first, you do not benefit, or do not benefit as much. One characteristic of being first is that you have to continually identify new products to be first in. Being first carries some risk, such as: Will this variety or crop yield well here? And, can I meet the quality requirements? Being first may allow growers to be less concerned about yield and expense because they are growing the crop for a price premium. However, being the low cost producer will be of a benefit no matter what you produce.

Different: Being different-or more specifically, differentiated-means producing something that most others are not willing or interested in producing. A good example of differentiation is organic production. Organic products generally command a price premium in the marketplace. Producing organically will require changes in the way you farm. Some growers are willing to make those changes, and others are not. That is precisely why there is a price premium.

The take-home messages:

- You can be successful by being first, better, or different.
- Most producers strive to be 'better' - be the low cost producer of commodities.
- There is a price premium for being first, but you have to continually identify new things to be first at.
- There is a price premium for producing something different, but you will likely have to change your operation in some way to produce for this category.
- The biggest price premiums are obtained when you combine more than one of the categories. For example, being the first to produce a different product may have huge price premiums. Being the low cost producer (better) will benefit you no matter what you produce.

The current situation and future trends suggest that it will be more and more difficult to be successful by simply being better. The low cost producers are likely to be increasingly from places such as South America, Canada, and New Zealand. The key to future profitability lies in our ability to become first and different, and do it as quickly and efficiently as possible.

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 25 **November 10, 2000**

In this Issue

Profitability Enemy #1: Excess Water
Consider Tile Drainage as Part of the Solution

Zachary Fore, U of M Extension Cropping Systems Specialist

There is a simple formula for profitability in agriculture: Yield x Price - Expenses = Profit. This means that to increase profitability we have to increase yield, increase price, and/or decrease expenses. Farmers need to continually work on all three of these. Which one do you think is the most important? Where should you spend most of your effort? The answer to these questions varies from farm to farm. However, a close look at the available crop production and economics data reveals a clear story: The major cause of poor profitability in crop production enterprises in recent years on most farms in the northern great plains is poor yield. You may be thinking that this is quite obvious - poor production results in poor profitability. When the most profitable operations in Northwest Minnesota are compared to least profitable operations, yield is over 4 times more important than price (marketing), and more than 13 times more important than expense management. This doesn't mean you should ignore marketing or expense management. The point is that when your yield is up your marketing and expense management efforts are much more meaningful.

If production (yield) is the key to profitability, the next question we should ask is 'What are the major factors limiting production?' Many possibilities come to mind. Late planting, poor stand establishment, poor weed control, diseases, delayed harvest, etc. My own observations as well as visits with many farmers and crops specialists indicate that excess water has been by far the factor limiting production the most during the past decade. Wet soils lead to many other production problems, such as delayed planting and harvest, poor stand establishment which leads to weed problems, general plant stress which leads to diseases, etc. A lot of good management decisions regarding crop and variety selection, weed control, fertilizer use, planting date, planting rate, etc. are completely negated by excess water. Until we manage water we will not obtain the benefit of all these other good management decisions.

So how do we manager water? We have a long history of surface drainage. Surface drainage is a very important component of a successful water management system. Subsurface (tile) drainage can also be a very important component. Farmers using yield monitors in areas where tile drainage is common are observing large yield responses due to tile drainage. And, they are acting on this information. In Minnesota alone, contractors have been installing 100 million feet of tile annually for the last four years. The vast majority of this tile is being installed in Southern Minnesota, with very little installation in small grain growing regions of Minnesota or the Dakotas. What do farmers installing tile drainage expect to get? Increased production and reduce yield variability from year to year. They realize that high, consistent production is critical for any business. The University of Minnesota has begun several tile drainage research projects looking at economics, yields, and water quality. Results of this research are not yet available. However, an excellent long term study in Ohio demonstrated the benefits of tile drainage in combination with surface drainage, and the resulting increases in production and decreases in yield variability.

Drainage Effects on Corn Yields
Ohio, 13 Year Study

Drainage System	Yield (Bu/A)	Yield Variation (CV%)
Undrained	60	46
Surface Drained	92	33
Tile Drained	116	18
Surface and Tile Drained	121	17

Why is there not more tile drainage in the Northern Great Plains? Producers have a number of questions and concerns about tile drainage. Dr. Gary Sands, Agricultural Engineer at the University of Minnesota, has developed a fact sheet addressing the most commonly asked questions about tile drainage. Below are a few of these questions and concerns about tile drainage, and some abbreviated responses to them. The entire fact sheet as well as a lot of other useful information about tile drainage is available on the web at www.smallgrains.org/drainage/home.html.

Question/Concern: My fields are too flat and my soils are too heavy (too much clay) for tile drainage.
Response: The amount of slope and the soil texture of a field will influence the design of the tile drainage system. Very flat fields can be tile drained. Tile can work effectively with grades as little as 6 inches per 1000 feet. Heavier textured soils will require tiles to be placed closer together.

Question/Concern: What if I don't have an adequate outlet for a tile drainage system?
Response: Adequate outlets can be designed where natural outlets are inadequate. An inadequate outlet can often be overcome by using a lift pump to pump water from the tile outlet up into the natural drainage system.

Question/Concern: My land values aren't very high and input dollars are hard to come by. How can I justify the expense of tile drainage?
Response: Land values have nothing to do with the decision to install a tile drainage system. The proper question is, 'Do I get an adequate return for my investment in a tile drainage system?' Although data is currently limited on yield response to tile drainage in the small grain growing region, the growers in the region who have tile drainage have generally been quite pleased with their return on investment.

Question/Concern: Tile drainage may be great in wet years, but won't I stress my crop in dry years?
Response: It is important to remember that tile drainage removes excess water, but does not remove plant available water from the soil. Clearly, the

greatest benefits of tile drainage are realized in wet years--but because tile drainage promotes deep root development, crops in tile drained fields will have better access to soil moisture in dry years.

Question/Concern: What will tile drainage do to downstream flow and flooding?
Response: Surface drainage increases peak surface runoff rates. Tile drainage typically reduces both the volume and peak of surface runoff from agricultural fields. Tile drainage is much more likely to decrease flooding problems than increase them.

Question/Concern: Could I install a tile drainage system myself, or have a neighbor do it, to cut cost?
Response: This is certainly an option, but one that must be approached carefully. One of the most important considerations of your tile installer is experience and familiarity with design procedures and standards of tile drainage systems. Depth, grade, pipe size, and field layout are all extremely important in design and will determine the quality of performance of your system. Another important consideration is installation method. Pull-type tiling machines may not perform adequately in all situations. The lifespan of properly installed corrugated plastic tile is quite long, and some that was installed over a generation ago is still performing well. Once the tile is in the ground, it's there to stay, so make sure installation is done correctly to avoid performance and longevity problems!

Conclusion
Seriously consider tile drainage in your farm operation. Contact a tile contractor or installer, determine the best place to start, and give it a try. You don't have to tile the whole farm at once. For a reasonable investment you can get a good look at a production practice that may have a very major positive effect on your farming operation for the foreseeable future.

Midwest Ridge- and Strip-Till Conference

George Rehm, Extension Soil Scientist

The 2001 Midwest Ridge- and Strip-Till Conference is scheduled for February 1st at the Village East Conference Center in Spirit Lake, Iowa. This Conference is designed for farmers who are currently using either the ridge-till or strip-till planting systems as well as those who might be thinking about using either system in the future.

Topics on the program range from economics to insect management to drainage. The information will be presented by farmers and University faculty. This is an event where farmers can learn from each other.

The program will start at 10:00 a.m. and will be finished at 3:00 p.m. Additional information is available from the local county Extension office.

20th Annual Crop Pest Management Short Course
November 20-21, 2000

Kevin Cavanaugh, Dept. of Agronomy and Plant Genetics

The 20th Annual Crop Pest Management Short Course will be held November 20-21 at the Earle Brown Continuing Education Center located at the University of Minnesota St. Paul campus. This program is designed for agricultural professionals, such as private crop consultants, agronomists, agrichemical advisers, soil conservationists, seed company sales/agronomists, government agencies, and university extension educators. This two-day program provides in-depth, high quality coverage of contemporary issues in crop pest management and crop production. The morning general session of November 20 will have two parts.

Part 1. What is Behind the Cause of ?Yellow Soybean Leaves??

This part will offer several speakers addressing iron chlorosis, nutrient deficiency, root rots and SCN, herbicide injury, and cultivar tolerance and the interactions these factors play in causing soybean leaves to turn yellow. Short presentations of each topic will be presented followed by a panel discussion. The audience is invited to bring their observations and share them in the question and answer session with the panel.

Part II. Effects of Agribusiness Restructuring on the Supply/Service Industry

The keynote speaker for the morning general session will be Dr. J.B. Penn, Senior V.P. of Sparks Company, Inc. His presentation is entitled, ?**The Changing Structure of the North American Supply/Service Industry.?** Dr. Penn has extensive experience in international agricultural and food policy. His experience has come from a variety of positions as an economic consultant for over 19 years on economic policy developments in the United States and around the world. He has served as a Senior Staff Economist with the President?s Council of Economic Advisers and as an administrator, staff economist, and research economist with the U.S. Department of Agriculture.

An application for CEU has been made in the following categories.

November 20	
2.0 CEU-CM	What?s Behind the Yellow Cause of Soybeans; Effects of Agribusiness Restructuring on the Supply/Service Industry
1.5 CEU-SW	Managing Nutrient Runoff on Cropland
1.5 CEU-PM	Sensing, Guidance, and Spray Drift Technology: Its Applications in Row Crop/Pest Management
November 21	
4.0 CEU-CM	Concurrent Sessions

On November 21, concurrent sessions will cover a variety of topics such as soybean aphids, bean leaf beetle, SCN, soybean root rots, herbicide adjuvants, milkweed management, waterhemp management, soil fertility, climate trends, alfalfa weed management, and transgenic development in corn rootworm control. Each of the concurrent sessions will be repeated at least two times.

On November 20 the program will begin at 9:00 a.m. and conclude at 5:15 p.m. On Tuesday the program will run between the hours of 8:00 a.m. and 3:00 p.m. A brochure showing the agenda and registration form can be obtained by contacting Tracey Benson, Extension Special Programs, at (612) 624-3708 or 800-367-5363. You may also view the program and register online on the Internet at: http://www.conferences.umn.edu/mn/crops/

Once at this site, click once ?Crop Pest Management Short Course? to view the agenda. You may register online at this site by clicking ?Register Online? or you can download a registration blank by clicking ?Registration Form.? Information on the program content can be obtained by contacting Kevin Cavanaugh, IPM & Ag Professional Program Coordinator at (612) 625-2778.

Plant Disease Clinic

Sandra Gould, Assistant Scientist

Samples submitted to the Plant Disease Clinic in October included:

corn-*Fusarium* sp stalk rot, cultured for storage mold
wheat-cultured for storage mold
soybean-*Phomopsis* sp & *Diaporthe* sp cankers & dieback
haylage-cultured for storage mold
potato-soils tested for *Verticillium* sp and nematodes
sorghum-cultured for storage mold
sugarbeet-soils processed for Aphanomyces root rot index
red oak-oak wilt
elm-Dutch elm disease
strawberry-*Verticillium* sp root rot
gerbera-*Phytophthora* sp root rot
aster-*Pythium* sp
poinsettia-*Pythium* sp root rot, *Sphaceloma* sp (scab)

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MINNESOTA CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 24 **October 13, 2000**

In this Issue

What Can I Do to Increase Soil Water Recharge for 2001?

John Moncrief, Extension Soil Scientist-Tillage

Many parts of Minnesota have had below normal rainfall and soil water levels are low. There is about 2" of plant available water in the five foot soil profile at the Southwestern Research and Outreach Center, Lamberton, MN. Most of it is below 3 feet. A full profile would hold closer to 10" of plant available water. The question many farmers are asking is what can I do to recharge my soils?

The best strategy is to do fall tillage that leaves the soil rough with a lot of surface depressions for water storage during snowmelt next spring. Moldboard plowing actually results in very little snowmelt runoff because of the storage provided. The problem is that after secondary tillage is done in the spring and the crop planted there isn't any benefit of crop residues to retard runoff and increase infiltration during spring rains. Fall chisel plowing provides the surface storage during snow melt and also soil cover with crop residue after planting to reduce soil water evaporation and increase infiltration during rainfall. Surface storage is especially prominent if fall chisel plowing is done on the contour due to the "cross slope" ridges that are left.

Standing stubble will increase "snow catch". Research at the West Central Research and Outreach Center, Morris, MN has shown that water in the snow catch with corn stubble in a ridge till system will hold, on average, 4 times the water in the snow above a fall moldboard plowed field. Unfortunately a high percent can runoff in the spring if rows are not planted across the slope. This is especially true if the soil surface is bare of snow cover during early cold weather before appreciable snowfall. Research has shown that it only takes about 4" of snow to

effectively insulate the soil and prevent freezing down to -30°F. If sufficient snowfall occurs before cold temperatures freeze soil, infiltration of snowmelt will be enhanced. Another factor is the soil water content at "freeze up". If the surface inch or so of soil is dry there will be more infiltration of spring snowmelt than if it is wet.

If soils stay dry and there is appreciable available soil water storage capacity the nitrogen associated with fall applied manure and/or nitrogen fertilizer is not likely to be leached beyond the reach of next year's corn. This may make fall application a possibility where on average it isn't a good idea. It also has implications on the appropriateness of the soil nitrate test. Crop consultants recognized this in the drought of 1988 and applied the spring soil nitrate test in 1989 in areas of the state where it usually is not recommended saving farmers the cost of nitrogen and reducing losses to the environment.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Preplan Your Control in Weedy Fields for Next Year

Field studies conducted in Wisconsin during 1996 and 1997 and in Ohio from 1992 to 1994 found that where early-season weed competition was severe, Roundup over Roundup-Ready soybeans work well when the application is timely, but that where timely glyphosate application is not possible a preplant residual herbicide is very beneficial. Working with lambquarters, use of a preplant residual chemical along with an early post application of Roundup controlled 86% of the weeds. However, the best soybean yields were obtained when timely Roundup applications were made (usually at least two applications, particularly an early post application in 1996 and the late post in 1997 due to climatic conditions that differed and weed emergence differences). Indeed, control of common lambsquarters, velvetleaf and giant foxtail averaged 90% across all residual combinations and glyphosate timings and rates when applied in a timely manner. Use of only a late post application of Roundup across the years, however, resulted in lower soybean yields compared to the more timely applications. In Roundup-Ready corn, a Missouri study and a south-western Ontario study similarly found that pre- and post-treatment programs produced three of the top net income-producing applications. One of the other top treatments was a sequential post treatment of Roundup (more than one application). Accurate timing of herbicide application is essential to produce effective results and control of early season weeds can greatly affect crop yield. Herbicide effectiveness is dependent on timing, weed species and weed size at the time of application. Read more on the results of these studies in "Weed Technology," volume 14, number 3 on pages 480-487; 495-501; 569-577; and, 578-585.

Rotate and Control Weeds to have Semiarid Corn Succeed

Corn grown in a dryland rotation is often more influenced by poor weed management sapping soil moisture than by any other constraint. Weed management is difficult when the corn canopy is not competitive with weeds early in the season, particularly against grass weeds. Row spacing, plant population and nitrogen placement are three cultural systems that might be used to influence weed management and corn yield. In South Dakota, a study ("Weed Technology, volume 14, number 3, pages 630-634) using row spacing at around 15 inches and a planting population just over 19,000 plants per acre where nitrogen was banded near the corn seed could reduce grass weeds 60% compared with a conventional system of row spacing at 30 inches and a planting population around 15,000 with broadcast nitrogen. Indeed, of all the variables, row spacing had the greatest effect on grass weed control but the higher plant populations and nitrogen banding also contributed to corn competitiveness and tolerance of weeds. Semiarid corn production must consider management strategies to limit moisture and yield losses from weeds that can lower yields and

produce smaller profit margins. Further strategies to consider from the South Dakota research include designing rotations within variable crop sequencing so that two winter/spring annual crops can be followed by two summer annual crops. This strengthens weed management by using a natural weed seedbank decline leading to lower weed densities (for example, green foxtail densities decline 90% or more if seed entry is prevented for two years; green foxtail seed production is more easily prevented in two years of winter/spring annual crops where harvest occurs before green foxtail flowers allowing postharvest operations to control weeds before seed formation). In North Dakota and north-western Minnesota, this crop sequencing is more difficult due to the very short growing season; however, winter wheat might be a viable option in variable crop sequencing to limiting foxtail seed production for two years before returning to other summer annual crops such as soybeans and corn. In fact, a second benefit is to increase winter wheat residue quantities on the soil surface that also limit weed seedling emergence. As residue quantities increase, weed seedling emergence is reduced 25 to 40%, especially if residue exceeds over 2600 pounds of residue per acre, using higher winter wheat seeding rates during the two years of this crop sequencing. Consider rotational and cultural strategies on your farm to limit existing weed and moisture problems.

Visualize Your Weed Problems

A Nebraska study compared the consistency and accuracy of visually estimating weed biomass and weed control data to information obtained through image analysis. Working in soybean herbicide efficacy trials, the researchers took measurements based on visual estimates and from aerial photographs. The visual (general, subjective weed control estimated by a researcher) ratings on weed biomass and weed control were not closely correlated with the aerial photograph results that used pixel values to estimate biomass and control. In fact, the aerial photos predicted yield more closely than the visual estimates based on more consistent estimates of weed control. Visual estimates were less consistent and more subject to the observer bias than measurements obtained with the photographic method. Inconsistent estimates have been found to be produced by experienced and inexperienced observers alike but can be improved if the observer is provided with a reference device such as a grid or mental reference (as shown in testing evaluations on plant disease, Aspects Appl. Biol. 43:205-214). Over time, as technology improves, use of image analysis may help in determining better weed control and also more closely estimating crop yield during the season. Image analysis provides a technology-based method for developing more accurate tools for weed control measurements. Perhaps the technology now being experimented with to detect weeds to spray can be adapted to measure weed cover by species over time.

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 23 **www.extension.umn.edu** **September 22, 2000**

In this Issue

Fertilizing This Fall

George Rehm, Extension Soil Scientist

So far, this has not been a typical Minnesota fall. There are two major differences. The harvest of both corn and soybeans is two to three weeks ahead of schedule. In addition, the price of anhydrous ammonia and other nitrogen fertilizers has increased considerably when compared to past years. The combination of these two facts leads to thoughts of earlier fertilizer application. The early application of nitrogen fertilizers, however, is discouraged. This is especially true as the prices increase. There are several valid reasons for a delay in the application of nitrogen. These are listed in the following paragraphs.

Most farmers will agree with the concept that keeping risks to a minimum is one of the most important keys to profitable crop production. Early fall application of nitrogen fertilizers is one risk that can be avoided. If applied in early fall, nitrogen applied as either anhydrous ammonia or urea will convert to nitrate-nitrogen. Nitrogen in the nitrate form can be lost next spring by either leaching or denitrification. This potential for loss is a risk that can be avoided.

The Best Management Practices for use of nitrogen fertilizers clearly state that fall application of nitrogen fertilizers should be delayed until the soil temperature at a dept of 4 inches reaches 50°F. In northern Minnesota, this may typically occur in mid-October. This date changes to about October 20th in central Minnesota and October 30th in southern Minnesota to the Iowa border. The negative economic aspects of nitrogen loss cannot be ignored. Lost nitrogen cannot be recaptured for later use. As the cost of nitrogen fertilizer increases, the importance of preventing loss increases.

Patience! Patience! Patience! Yes, it's traditional to apply nitrogen fertilizer soon after soybean harvest. However, harvest is ahead of normal. Yet, using patience this year could prevent the loss of expensive nitrogen.

Dry soils must also be considered. At the time of this writing, topsoil moisture across most of Minnesota is deficient. Anhydrous ammonia must be absorbed by soil water or it will be lost by volatilization. We usually associate volatilization with the white fumes behind the anhydrous applicator. If soils are dry, volatilization losses can be slow and take place over a day or more. Nevertheless, this is nitrogen loss that can be avoided. A delay in nitrogen application this year increases the probability that there will be rains that will produce increases in soil moisture.

Thinking back, most crop producers in Minnesota have experienced warm fall weather for the past two years. Some who applied nitrogen early in these years have complained of reduced yields when compared to their neighbors. The reduced yields were probably the result of nitrogen lost from early application of nitrogen fertilizer. So, farmer experience and research is telling us that early fall application of nitrogen fertilizer is not a good management practice.

Even though the price of nitrogen fertilizers has increased, it's still important to match rate to anticipated yield or yield goal. There is more economic return from the application of nitrogen when compared to the application of other nutrients. There is no recommendation to cut corners with the application of nitrogen.

The higher cost of nitrogen could change some thinking about the application of other nutrients. Growers should purchase the amount of nitrogen fertilizer needed first, then take a close look at phosphate, potash, and other essential nutrients. Are they really needed for optimum yield? Is the recommendation needed to provide for optimum yield or maintenance of the soil test level?

Even though fertilizer costs are rising, common sense is still very important.

Research Plots To Determine Crop Response To Tile Drainage In NW Minnesota

Gary Sands, Extension Engineer
Hans Kandel, Red Lake County Extension Educator
Zach Fore, Extension Educator, MN Wheat Growers Association

Throughout the 1990's excess water has significantly impacted crop production in the region (Becker, Clay, Clearwater, Kittson, Mahnomen, Marshall, Norman, Pennington, Polk, Red Lake, and Roseau Counties). This was particularly evident in 1999 when 683,000 acres were not planted and an additional 239,000 acres were seeded but not harvested due to excess water. These unplanted and unharvested acres represent approximately 25% of the total crop acres in the region and approximately $193 million in lost production. In addition, excess water caused large yield losses on acres that were harvested. In the nineties, the wettest decade on record, yields of major crops were 20-30% below attainable yields, due, in part, to excess water.

Surface drainage is a very important component of a successful water management system. Studies in the Midwest and elsewhere have shown that surface drainage combined with subsurface (tile) drainage can be an even more effective water management practice. Tile drainage can help to establish more optimum conditions for field operations and crop growth by lowering perched watertables. Although tile drainage is a very popular water management practice in southern Minnesota, there has been very little installation in small grain growing regions of Minnesota or the Dakotas. Anecdotal evidence from Northwest Minnesota farmers who have tile drainage suggests that there are real benefits to be gained from this practice, but flat topography, tight soils and a historical surface drainage culture still limit its widespread appeal. The lack of regional

research-based data on crop response to tile drainage is also a significant limiting factor in the adoption of these practices. Although much drainage research has been conducted in other parts of the country, it is critical that crop response be assessed locally, to take into account the unique climate, soils, and landscapes of Northwest Minnesota.

Two 8-acre research and demonstration sites will be established near the Northwest Research and Outreach Center-Crookston and Brooks, to investigate the response of wheat, soybeans, and sugarbeets to three drainage spacings, compared to an undrained control plot. The drain spacings will correspond to the 1/4-, 1/2- and 3/4-inch water removal per 24-hour period. A lift station will be installed at the Crookston site to provide for an adequate outlet. Planting direction will be perpendicular to the tile drains. Yields will be measured with plot combines. Shallow watertable wells will be established in each plot for automated monitoring of watertable depths to five feet. Automated soil moisture measurements will be made at 6-, 12-, 18-, 24-, and 30-inch depths within each drain spacing zone and the control plot. Soil moisture measurements will be used to estimate field trafficability during spring and fall operations.

The question many farmers need answered is whethertile drainage represents a profitable investment, and the new three-year research plan aims to determine the economic feasibility of tile drainage for small grains, soybeans, and sugarbeets for the region. Community education on the various aspects of water management and drainage will also be provided through this project. An annual drainage field day is planned to demonstrate alternative water management and drainage practices. This year's field days are scheduled for the Crookston site on Wednesday 27, 9:30 a.m. on the Gary Wagner farm 2.5 miles west from the Crookston Experiment Station along Highway 2, rain or shine. The other plot tour will take place Thursday 28 September, 9:30 a.m. at the Brooks site. From Brooks, MN, go 2.5 miles east on county road 92 and turn south on a dirt road for 0.75 miles. The research field, on the Keith Swenson farm, will be along the east side of the road. In case of rain the meeting will take place at the Oklee Community Center. The field days will be showcasing the installation of the tile and information about tile drainage will be provided. The day is open to the public and refreshments will be served.

For further information, please contact either your county Extension office or Zach Fore 218-253-4401.

Project Sponsors:

- Minnesota Agricultural Experiment Station (Rapid Agricultural Response Fund)
- Wheat Research & Promotion Council
- PRINSCO INC.
- University of Minnesota Extension Service
- University of Minnesota Northwest Research and Outreach Center

Dormant Seeding Canola

Hans Kandel, Red Lake County Extension Educator,
Paul Porter, Research Agronomist
Dave LeGare, Scientist

In farming we look at many different crops and in which sequence they can produce the highest economic return. We try to diversify the crops and the systems we use. One of the newer systems is fall seeding of canola, either with a seed coating or late enough to prevent germination in the fall. Dormant seeding of canola is an innovative management practice we may want to include in cereal crop rotations, since canola has become a significant crop in the northern regions of Minnesota. By seeding canola in the fall after soil temperatures have dropped below freezing, the seed does not germinate until the following spring. When successful, Canadian researchers showed that dormant seeding increased canola yield by 17 percent over late April and 64 percent over mid May seeding dates. Here in Minnesota, preliminary research shows that the method may have promise. In one study on fallow

land at the Canola Production Center near Thief River Falls, canola planted Nov 16, 1999 yielded substantially more than that planted on May 2, 2000. A second study with the same planting dates but on wheat stubble, however, showed a lower yield with the fall-seeded canola.

With the development of herbicide-tolerant canola varieties, it is now feasible to control or remove competitive winter annual weeds and volunteer grain that also emerge early in the spring with the dormant seeded canola. In fact, some producers have incorporated herbicide-resistant canola into cereal rotations as a "clean up" crop. Dormant seeding may prove to be helpful in moving canola into production regions where high temperature and moisture stress during flowering hinder seed formation and development. The use a of polymer seed coating delays canola seed from taking up water in the fall, and may help improve the success of dormant seeding canola when planted relatively early in the fall. Without some form of seed coating, the farmer is forced to delay planting until soil temperatures drop to at or below freezing.

The most pressing concerns still are premature germination and de-hardening of plants in the spring, making them susceptible to frost. It appears extremely critical that dormant-seeding be delayed until temperatures are sufficiently low to inhibit fall germination. Typical seeding rate is 17-seeds/square foot (approximately 5 lb/A), and seed should be pretreated with a systemic insecticide for flea beetles and a fungicide for seedling disease. The use of herbicide-tolerant canola for dormant seeding should be considered because typical stand densities will be one-quarter to one-half the density of spring-planted canola. Thus, the fall-seeded crop is less competitive and needs help to fend off weed pressure.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Simplify Soybean Savings by Lessening Losses

A poorly adjusted combine can cost you six to eight bushels of soybeans per acre. Preharvest losses may also occur if pods and beans shatter from the plants before harvest. Harvest losses may be caused by loose beans or pods that shatter on the cutterbar, reel or cross auger; pods that are cut off but drop before entering the combine; pods on lodged stalks; pods attached to uncut stubble; and, cylinder and separating losses. Measure harvest losses by counting the beans in an area of 10 square feet. Forty beans in an area of 10 square feet is about one bushel per acre loss. Reasonable losses during the harvest operation should be below two bushels per acre. If major losses are incurred due to preharvest problems, consider a variety change in order to better your bean yield next year.

Lessen Losses for More Cash from Corn

While harvesting your corn crop, prevent losses in order to up your yields. Preharvest losses can be your largest losses if hybrids are not chosen carefully. This includes ears that drop from the stalk before harvest. If ear drop is prevalent, consider reevaluating your seed choice when deciding what hybrid to grow next year. Other losses include harvesting losses from ears dropped or missed by the combine, loose kernels dropped as the stalk rolls into the header, cylinder losses from kernels not shelled and separating losses from loose kernels not shaken out. Losses from both preharvest and harvest intervals increase as stalk lodging increases and as weediness in fields increases. Lessen your losses in corn by considering if preharvest or harvest operations can be improved in each field.

End of Season Soybean Questions

1. I had two varieties of soybeans in the field by my house, but when the light frost came through one variety seemed to recover better than the other one. Why? Soybeans are easily damaged by frost, but at 32F or just above, some soybeans may come out of the

cold just a little better than other varieties or individual plants. Location in the field may make a difference as cooler temperatures may linger in low spots longer. Also, preconditioning makes a big difference. A few early frost scares may condition some varieties or individual plants more than others.

2. At what temperature, will a quick kill result on soybeans? Temperatures at or below 28F for any length of time will usually result in complete soybean kill.

3. A few of my soybeans I have harvested are green. If I slowly dry down the beans, will this color disappear? Usually green beans harvested will remain green and may even be soft and will shrivel. If you can't pinch the green bean between your finger and thumb and mush it down, drying will result in less shriveling and occasionally with a month of storage, some green beans may change more to the yellow color you would like.

4. Can't I just determine the best harvest time by the color change in the soybean leaves and pods to brown? Actually, a moisture reading should be done to see if soybeans are at least at 18 to 16% moisture, if possible. Keying color change in leaves and pods to harvest timing doesn't always work as different varieties under different moisture and temperature conditions may vary in their "color" signs of maturity. As proof, did you notice how long many soybean varieties remained green toward the end of the season this year, partially due to those end of the season rains!

5. Can I somehow look at the soybeans and estimate maturity? Yes. Open a few pods (at random over the plants because remember that beans usually mature from the top down) and check the shrinking of the beans from the pod. If the beans are completely separated from the white membrane inside the pod, they will not gain any more test weight remaining in the field.

6. Is there a stage in soybeans when I know a frost at that stage will result in yield loss? Yes. A frost at or before R6 or the full seed stage will result in yield loss of up to 53%. The previous stage, R5 or beginning seed can have drastic yield losses (greater than 75%).

7. Once a frost occurs, does dry-down in soybeans slow? Not necessarily. Temperatures and moisture after the frost determine dry-down timing as does the stage of maturity of the beans at frost.

8. The pods on my soybean plants were still green when the frost hit. What should I do? Check to make sure the beans were at or past R6 or full seed and wait for the pods to mature before combining if conditions allow it.

9. Does row-spacing affect soybeans sensitivity to frost? Right around the 32 to 28F temperatures, row-spacing may greatly affect the potential of frost on soybeans. Narrower row spacings can have slightly more tolerance to light frosts than wider rows, depending on the stand. A more complete plant canopy can hold in soil heat better.

10. If the soybeans are just at beginning maturity, will a frost affect yield? You can have up to 5% yield loss. Only at full maturity, R8, are soybeans not usually affected by frost. Delaying harvest too long, however, can result in yield loss due to pod splitting or dropping or stalk lodging as well as possible deterioration from field weathering.

11. If my soybeans don't lose the green color in storage, can I still sell the beans? You might be able to find a buyer that will purchase the beans at a discounted price, probably to be used in soybean meal production. Green soybeans used in processing soybean oil create problems. The green color has to be masked or removed--both taking more time and expense. Refiners check soybeans routinely for green beans (or the chlorophyll) remaining in soybeans.

End of Season Corn Questions

1. What really determines the severity of frost damage on corn? The duration and extent of subfreezing temperatures will determine the damage received.

2. When does tissue damage occur versus actual kill of corn tissue with a freeze? Over 4 hours of temperatures below 32F can result in tissue damage on a corn plant that can eventually be detrimental. Quick kill of the corn plant, however, will occur with 4 hours of temperatures at or below 28F. Individual plant conditioning and placement in the field, particularly whether the plant is in a low or high spot in the field may also moderate the temperature conditions and effects.

3. With a frost, will absolutely no more assimilation toward grain fill continue? It depends on how much leaf and stem tissue is killed. If only a portion of the leaves are killed on a plant, the rest may still be able to continue and function to grain yield with returning good weather conditions.

4. Does timing of a frost on a corn plant affect test weight as well as yield? Yes. The later the maturity of the corn crop the less affect frost has on corn yield and corn test weight.

5. When is corn completely safe from damage from a frost? Corn at physiological maturity, or black layer will not have any yield reduction from a frost.

6. Is there a decrease in kernel dry-down after a frost in corn? Although this question has often been answered both ways in research, more recent studies have shown that kernel moisture loss may not decrease after a frost. Instead, other conditions such as a tight husk or even specific hybrid type may have more to do with any slow down of dry-down in corn following a frost. Also, remember that temperature and relative humidity of surrounding air also may influence kernel dry-down in corn.

7. Can you make silage from frosted corn? Yes. Carefully consider the corn maturity in order to determine if silage is a possible route for your frosted corn. Optimum silage is cut at around 62 to 68%. If the corn is at only the milk stage, the whole plant moisture level is high so that silage will be very wet and will sour quickly. Nutrient loss will be high in storage and livestock consumption will be low. Consider letting corn at the milk stage dry down below 70% in the field or consider the addition of eatable absorbent materials such as ground grain or straw in the mix. The dough stage of corn is also too wet for good silage and proper storage. Also consider field drying to below 70% total plant moisture before cutting for silage. The best time for silage is at mid-milk line (past initial dent) when whole plant moisture content is around 68%. Value of silage depends on use or probability of purchase. In general, pricing will be low as a quick rule of thumb is to multiply the current price of corn grain by six to determine the rough value of a ton of silage, and then subtract out harvest costs for your final value.

8. My corn was frozen during the milk stage (kernel moisture is around 80%), will the grain still be okay? Yield potential for grain will be very low. In fact, you probably will obtain less than 50% of your expected yield from the stand. Also, the grain will be very chaffy and kernels will shrink readily when dried down by heat. Green-chopping or ensiling may be a better route, although by no means optimum.

9. How much yield can I expect if my corn crop is in the dough stage (70% kernel moisture)? Your yield reduction will be 35 to 50% of the expected yield from a crop that had made it to black layer or physiological maturity.

10. My corn just dented when the killing frost came through my field. Will I have any yield loss? Yes. Yield reduction at dent will be 10 to 20%.

11. My corn dented and the milk line was half-way down on the kernel. Did I get any yield loss from the killing freeze? At mid-milk line, the kernels are at about 40% moisture and close to maturity, but 4 to 5% yield loss should be expected.

12. Will I have any problems with my corn if it reaches physiological maturity and harvest moisture, but I can't get out to harvest it? Delayed harvest may result in loss of yield due to seed or ear loss and stalk lodging. Some loss of quality may also result with lower bushel weight and deteriorated grain due to field weathering.

Plant Disease Clinic

Sandra Gould, Scientist
Plant Disease Clinic

Samples submitted to the Plant Disease Clinic in late August and September included:

soybean-*Diaporthe/Phomopsis* sp. cankers, *SCN, Septoria* sp. and downy mildew leaf spot, Brown stem rot
maple-Verticillium wilt
oak-Oak wilt
ash-Verticillium wilt
elm-Dutch elm disease
poinsettia-*Pythium* sp. and *Phytophthora* sp. root rot, *Sphaceloma* sp. (scab)
Hosta-foliar nematode
Chrysanthemum-white mold
Spathiphyllum-*Cylindrocladium* sp. stem and root rot
Kalanchoe-*Phytophthora* sp. stem and root rot
Campanula-*Phytophthora* sp. root rot, *Phoma* sp. stem rot
pepper-impatiens necrotic spot virus (INSV)

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MINNESOTA

CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In this Issue

Week Of Downtime At Harvest Can Cost a Farmer Up To $5,400

John Shutske, Agricultural Safety & Health Specialist
University of Minnesota Service

An injury or other unexpected delay that causes a farmer to miss a week of work during fall harvest can cost as much as $5,400 just for the lost time. That doesn't include medical costs, insurance deductibles, or other related expenses.

I have been studying the estimated dollar cost of "downtime," or work time lost, during the harvest season. I use a computer program that simulates a "typical" crop production season where time is an important variable. Time is then "removed" to simulate downtime resulting from unexpected events such as mechanical breakdowns or personal injuries.

Farmers have long known that time lost during harvest costs them a lot of money. As harvest gets pushed later into the season beyond the ideal time, grain losses accumulate. Corn ears drop to the ground, soybeans shatter, or wind blows the crop down. Losses can be huge if it snows early in the season, especially if that comes on top of harvest delays from wet weather. And a delayed harvest can take away time from fall tillage, which can mean late planting and yield losses for the next year's crop."

Downtime most frequently occurs from mechanical breakdowns, injuries to the operator or a family member, machinery fires, and bottlenecks in moving, drying, storing, or handling the crop.

The computer model represents an 800-acre Minnesota corn and soybean farm. The model considers seed, fertilizer, chemicals, machinery power, and labor. For the downtime study, the most important single variable is available field time when conditions are suitable for work.

Using this computer program, we can set up an 'ideal' farm scenario and then go back into the data and remove 'good field days' during busy times as a way of simulating downtime." Using weather data from southern Minnesota, we've found that in a "typical" year with fairly good fall weather, a day's worth of lost time costs a farmer about $300-325. If it's a little wetter than usual, the cost is $325-400 per day.

But in a year with 25 percent fewer harvest days than the median, the cost jumps to as much as $550-600 per day. The total loss can reach up to an extreme of $900 per day if the delay is enough to interfere with necessary fall tillage or if there is an unusually early snowfall.

A year with 25 percent fewer harvest days than the median is not uncommon. It happens an average of three out of ten years in southwestern Minnesota.

This study shows that an injury causing a week of downtime during harvest costs $1,800 to $5,400 for the lost work time, along with the other costs. And over a third of the people injured while working with machinery miss a week or more of normal activities. Taking steps to reduce the chance of an injury pays dividends in many ways.

The work has been supported by the National Institute for Occupational Safety and Health and the Midwest Center for Agricultural Disease and Injury Research, Education, and Prevention.

Safety Steps To Reduce Farm Work Injuries Can Pay Big Financial Dividends

John Shutske, Agricultural Safety & Health Specialist
University of Minnesota Extension Service

Avoiding farm work injuries that interfere with fall harvest can pay big financial dividends for crop producers. That is documented in a study . The study indicates that lost time during fall harvest in the upper Midwest can cost a producer over $300 per day. This total is separate from medical, hospital, and other related expenses.

Financial information derived from the study suggests:

1) Preparing machines before the harvest season will pay financially. This means performing routine maintenance, replacing worn parts, replacing safety shields, and making sure lights and flashers work and slow-moving vehicle emblems are clean. Machinery breakdowns during harvest are likely to result in frustration or anger that leads to excess stress as well as greater chance of injury.

2) Safety is of utmost economic importance. Steps to increase safety include repairing safety equipment, making sure shields are in place, blocking up the combine header before working underneath, and making sure you are very visible when traveling on rural roads. Many serious lost-time injuries occur when getting in and out of a machine, so make sure ladders, steps, and handholds are in good condition. When climbing up or down, always maintain at least three points of contact-one hand and two feet or one foot and two hands.

3) Combine fires are costly. Keep the combine and other machines clean. Watch for sources of combustible materials that could lead to a fire, such as leaky fuel lines, weak hydraulic hoses, and oil-soaked crop residue. Make sure there is at least one, and preferably two, ten-pound ABC dry chemical fire extinguishers on every combine. Smaller extinguishers are useless against a typical combine fire. If your combine does catch on fire, it's important to quickly pull away from

the standing crop (within a few seconds) and shut off the engine before trying to fight the fire.

4) Taking breaks is a key investment of a small amount of time to reduce injury risk and stress. It's important to get down off a machine every two hours or so, even for a five-minute leg stretch. Drink lots of water, even in cool weather. If you pack a lunch, include an apple, grapes, carrot sticks, or other fruits and vegetables. Fruits, vegetables, whole grains, and protein give your body the necessary energy and nutrition to meet the physical demands of long work hours.

5) Set up a communication system to minimize downtime costs. Some producers use CB radios or two-way radios, but cell phones are becoming increasingly common. They make it possible to improve scheduling, line up parts and repairs, and coordinate family activities. They also provide a way to get help in case of an emergency. But avoid using a cell phone when driving, even on rural highways. Recent studies have shown the potential for a roadway accident is four times greater when driving while using a cell phone.

This study has been supported by the National Institute for Occupational Safety and Health and the Midwest Center for Agricultural Disease and Injury Research, Education, and Prevention.

Saving Fuel in Corn Drying

Bill Wilcke, Extension Engineer

The combination of low corn prices and high fuel prices makes it especially important to consider ways to save fuel in corn drying this fall. Prices for both liquefied petroleum gas (LPG; mostly propane) and natural gas, the primary fuels used in heated-air corn drying, are expected to be much higher this fall than they have been the last few years. Typical heated-air corn dryers use about 0.02 gallons of LPG per bushel per percentage point of moisture removed. This means that every point of moisture removal that can be avoided in heated-air dryers will save about 0.02 gallons of LPG per bushel of corn harvested.

Here are some possible approaches for reducing fuel use in corn drying:

* Store ensiled high-moisture corn. Instead of artificially drying corn, livestock producers can consider storing some of their crop in silos or in silage bags as ensiled, high-moisture corn. High-moisture corn should be harvested at 25 to 30% moisture to get good fermentation.

* Delay harvest to take advantage of natural drying in the field. Harvesting at lower moisture means less water has to be removed during artificial drying. And for corn that will be fed during winter, livestock producers who delay harvest until temperatures drop to near freezing might be able to avoid drying altogether. If corn can be aerated in storage to keep its temperature near 30F, it can be safely stored at 18 to 19% moisture through the winter months. But the wet corn must be fed or dried by spring!

* Reduce overdrying. Corn buyers usually want corn at 14 to 15% moisture, and with proper storage management, corn can be safely stored for six to nine months at these moisture levels. Some stored grain managers intentionally dry corn to lower moisture levels to reduce storage risk. Overdrying corn is an expensive strategy, however, because it increases drying costs (especially when fuel costs are high), it reduces dryer capacity (bushels that can be dried per day) and it reduces the number of bushels that are available for sale.

* Switch to in-storage drying. If corn is currently dried at high temperatures and then rapidly cooled in the dryer, some fuel can be saved by cooling corn in the storage bin instead of in the dryer. Almost no moisture is lost when freshly dried corn kernels are rapidly cooled immediately after drying. But if corn

is unloaded from a dryer while it is still hot and is transferred to storage where it is cooled slowly using the storage bin's aeration fan, the corn will lose one to two percentage points of moisture during the cooling process. This means that if the final target moisture is 15%, the dryer can be unloaded when the corn reaches 16 to 17% moisture instead of drying it all the way to 15% moisture. In-storage cooling saves the fuel that would be needed to remove the last one to two points of moisture and it reduces the amount of time that corn spends in the dryer, which greatly increases dryer capacity. For more information, contact the Biosystems and Agricultural Engineering Department and ask for the bulletin Dryeration and In-Storage Cooling for Corn Drying.

* Use dryeration. Dryeration is similar to in-storage cooling, except that corn is intentionally left hot (called steeping or tempering) for 4 to 12 hours. During this tempering period, moisture and temperature gradients equalize within freshly dried kernels, which enables the kernels to lose two to three percentage points of moisture during cooling. Compared to rapidly cooling corn in the dryer, dryeration reduces energy use, increases dyer capacity, and improves corn quality (better test weight and fewer cracked kernels). It is best to transfer corn from the bin where cooling takes place to a different storage bin after it goes through the dryeration process to avoid problems that might be caused by condensation along the inside the walls of the cooling bin. For more information, contact the Biosystems and Agricultural Engineering Department and ask for the bulletin Dryeration and In-Storage Cooling for Corn Drying.

* Consider using natural-air drying. Natural-air drying is an in-storage drying process that uses bins equipped with full perforated drying floors and fairly large fans (approximately 0.75 to 1.0 fan horsepower per 1000 bushels of corn for bins that are no deeper than about 18 ft). Natural-air drying works well in the upper Midwest, but harvest must be delayed until corn moisture drops to about 22% moisture in the field and drying requires several weeks of fan operation. In many years, drying is not completed before winter and corn is kept cold during winter and drying is finished in early spring. Although natural-air drying uses no LPG or natural gas, it does use an average of about 1 kWh of electricity per bushel of corn to operate the drying fan. For more information, see the University of Minnesota Extension Service bulletin Natural-Air Corn Drying in the Upper Midwest, BU-6577.

* Use combination drying. If you don't like some of the limitations of natural-air drying, you can partially dry corn to about 20% moisture in a heated-air dryer and then finish drying it in a bin equipped for natural-air drying. Combination drying allows you to harvest corn earlier than you can with just natural-air drying, but it uses less fuel and produces better corn quality than complete heated-air drying. For more information, contact the Biosystems and Agricultural Engineering Department and ask for the bulletin Combination High-Speed, Natural-Air Corn Drying.

For more information on any of these topics, contact Bill Wilcke in the University of Minnesota Biosystems and Agricultural Engineering Department in St. Paul (wilck001@umn.edu or 612-625-8205).

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Simple Soybean Seasonal Summary

1. My soybean plants are showing rapid tip death while the rest of the plant remains green. What is wrong? Your soybeans might have top dieback, often also called tip blight. It is a disease that is caused by Phomopsis and Diaporthe, a group of plant pathogens that cause various diseases in soybean. Soybean varieties with top dieback should be considered candidates for replacement in your soybean lineup next year. However, don't confuse this problem with simple plant senescence or compounded stresses causing early plant senescence--which can be difficult to determine.

2. After the heavy rain a few weeks ago, my soybean plants in one portion of the field showed long, brown lesions up one side of the stem. Can I get any yield loss from this? Yes, yield loss can result if the soybeans are not near or at full maturity. The problem might be late-season Phytopthora in your field. In older plants that don't have tolerance to Phytopthora, even these mild symptoms can reduce yield as much as 40% if initiated early enough. Foliar blight by Phytophthora can occur after heavy rains. In some cases, the brown lesions may even be restricted only to older leaves on the plant, a phenomenon referred to as age-related resistance.

3. One of my fields looks like it has a brownish cast, like frost damage, rather than the normal yellow-green seen in a maturing soybean field. When a stem was split, a dark reddish brown discoloration was inside the stem, what is it? You probably are looking at brown stem rot. This disease may appear late in the growing season, especially on ground that has been continuously cropped to soybeans. The disease develops faster in older plants and can reduce yield. Rotate soybeans with corn or another non-host crop for three years, if possible, and use resistant cultivars where brown stem rot has been a severe problem.

4. My soybeans have spots that moved from the bottom leaves up the plant and increased in size with the recent cool, rainy weather. What is on my plants? If the spots are yellow to light brown and are started out small, angular and looking like they were water-soaked or had a yellowish green halo, you are seeing bacterial blight progress up the plant. The bacterium is spread during windy rainstorms and during cultivation when the foliage is wet. The disease is seldom devastating to the crop; however, avoid planting highly susceptible varieties and rotate soybeans with other non-susceptible crops.

Quick Corn Question Quiz

1. How cold does it have to get before corn is damaged? The severity and duration of sub-freezing temperatures determines damage. Four hours or more below 32F can cause substantial leaf, stalk and husk tissue damage as can only a few minutes below 28F. Frost damage on final grain yield depends on how much leaf tissue is killed and the plant stage of development.

2. Can molding and sprouting of corn in the ear affect feed quality? Yes, it can. Quantity of the molding as well as type of corn ear rot will determine the problem. Fusarium kernel rot results in a toxin called vomitoxin that can limit the quantity of damaged corn used in feed.

3. Compaction problems are still showing in my fields, should I try to chisel this fall? Subsoiling can reduce soil compaction, but only if your soil is dry. Tillage in the fall should shatter the soil so that compaction is limited. A cold winter with heaving and thawing will also help the compaction problem if several thawing-freezing cycles occur.

4. Does temperature and moisture affect grain storage time? Yes! Check out NDSU's bulletin on Crop Storage Management (AE-791) and the storage problem poster in your county agent's office or see about ordering from the web at: http://www.ext.nodak.edu/extpubs/#ageng

5. What causes corn plants to produce an ear on top of the plant? Crop genetics along with high fertility can cause ear development in the tassel area of the plant. This may also occur when the plant sustains hail or mechanical damage early in plant development. Yields shouldn't be decreased from a few plants showing this characteristic.

6. What causes that ugly corn smut in the field? Common smut is caused by disease introduction from Ustilago maydis which is most severe in infection when it invades

through young, actively growing, wounded plant tissue. You might also see more of the smut problem on tillers, although main corn plants can also have smut.

7. Can leaf disease on corn affect yield? Yes. Depending on severity and length of time the leaf disease infected the corn plant, it can affect yield. However, it is very difficult to estimate yield loss as each case may be different.

8. The corn ears on one field are not filling to the end, what is the problem? A nutrient deficiency or simply a series of stresses that limit corn filling can contribute to the problem. Potash shortage will show poorly filled tips and loose chaffy kernels; phosphate shortages show pollination interference and twisted rows and tip ends with

   random undeveloped kernels; and, nitrogen shortage will result in small ears, low protein content and kernels tips not filled.

9. On one of my corn plants, the ear is branched and has a second ear coming out below the first ear, is something wrong? It is just genetics and the poor pollination conditions showing in your corn. In some cultivars of corn, axillary branches produce secondary ears that can be large enough to harvest. In most modern hybrids, however, they develop when pollination of the main ear is poor and the small, secondary ears if developed, produce little.

10. Some of the kernels in my corn field have a split through the middle of each kernel that appears white in color, what is going on? You have popped kernel or silk-cut in your hybrid. Although common in breeder nurseries, the characteristic is rare on commercial hybrids. It is an inherited trait and the kernel may even resemble a partially expanded popcorn kernel or show the embeded silks in the ruptured areas that may be from irregular pericarp growth around unpollinated silks. Either condition is due to irregular plant growth during years with irregular rainfall. Change your hybrid! Both popped kernel and silk-cut result in the ruptured pericarp allowing easy infection by ear-rotting and saprophytic fungi.

Corn Care Coincides with Moisture Content

Grain moisture concentration is an indication of corn crop maturity and an indication of probable frost injury reduction to yield. Hybrids that reach black layer (R6, physiological maturity-PM) before a killing frost have yield already determined.

Kernel Stage	Moisture	Days to PM	Yield Loss
Dough, R4	70%	30	35-50%
Dent, R5	50%	20	10-20%
Mid-Milk Line	40%	10	4-5%
Black Layer, R6	30-35%	0	0%

Adapted hybrids to a region should do well during the season, withstand herbicide programs, have good plant health characteristics, withstand insect and moisture stress, grow well on the soils in the area, adapt to your field fertility program, and mature and dry down as well as show good yields.

Cool Temperatures Signal Soybeans to Senesce

Low temperatures and long days (short nights) route soybean plants into full seed maturity. With excellent growing degree day (GDD) accumulation this year, adapted varieties should be ready to harvest at least by September 20 to 30, if not before. Unfortunately, rains can delay dry down and place harvest on hold. However, timely harvest with good drying and storage can pay dividends by way of less deductions at the elevator. U.S. grade No. 1 soybeans should have a minimum test weight of 56 pounds per bushel; have less than 0.2% heat damage; have less than 2% damaged kernels; have less than 1% foreign material; have less than 10% splits; and, have less than 1% of soybeans of other colors.

Haste Makes Waste with Soybeans

Wanting to eliminate those weeds still hiding among the soybeans, may be a good idea but evaluate the benefits carefully before applying a desiccant. Applying a desiccant prior to physiological maturity in soybeans will reduce yield. Putting on the Roundup, Touchdown, Gramoxone Extra, Starfire or even Drexel Defol before soybeans have reached full

maturity will cause the soybean plants to die prematurely, similar to freeze injury, resulting in green beans. Green beans rather than mature soybeans at the elevator can result in heavy dockage or rejection of the soybeans. Only use a desiccant if a weed problem exists. And, even with weeds make sure the situation is dire enough that a delay in harvest would be caused without use of the desiccant. Use the desiccant only after soybeans have reached physiological maturity--when 95% or more of the pods have reached their mature color, the soybeans have begun to pull completely away from pod attachments, and the beans have lost that green color for a mature yellow-brown color. If applied on mature soybeans, the weeds and soybeans will then dry down at a similar rate and soybeans can then be harvested when they reach harvest-level moisture (15% or less moisture). Also, be aware of the preharvest intervals required: Roundup and Touchdown require 7 days before crop harvest after application, Gramoxone Extra and Starfire require 15 days and Drexel Defol requires 7-10 days

Mark Your Calendar for Black Layer

Around three weeks after beginning corn denting, fields should be entering black layer or physiological maturity (PM). The starch (or milk) line will have advanced completely to the kernel tip and a brown or black layer can be seen at PM or stage R6. Once black layer is seen, no additional kernel growth or weight will occur. Also, the husks and many leaves will no longer be green, however, the stalk may still show some green color. Average moisture at black layer is 30-35%, depending on hybrid and environmental conditions. Field drydown timing to acceptable moisture levels (20-26% for artificial drying, if possible, and 13-15% for safe, shelled storage) will vary after R6, depending on the hybrid and environmental conditions. Normally, from 35% moisture down to 25% moisture, corn will lose 3/4% per day regardless of weather. Below 25%, however, corn may only lose 1/4% per day with weather largely determining the rate.

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 21 www.extension.umn.edu **August 25, 2000**

In This Issue

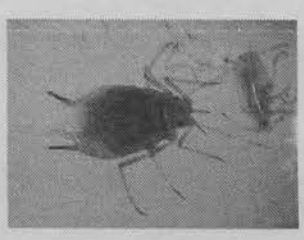
New Soybean Pest Appears in Midwest: Is it in Minnesota?

Drs. Ken Ostlie, Extension Entomologist and Bill Hutchison, Extension Entomologist

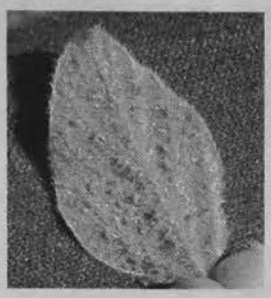
Since its introduction in the U.S., soybean has been free of some of the pests that haunt it in eastern Asia and Australia, particularly aphids. However, our aphid-free days appear to be over. Chris Difonzo, extension entomologist in Michigan and John Wedberg, extension entomologist from Wisconsin, recently reported aphids infesting soybean in Wisconsin, Michigan and northern Illinois. The aphid has been positively identified as the soybean aphid, *Aphis glycines* Matsamura, which infests soybean in China, other east Asian countries and Australia. At this time, its presence in Minnesota has not been confirmed.

Mark Abrahamson, with the Minnesota Department of Agriculture – Crop Survey Program, is coordinating a state-wide survey effort this week. We would also appreciate your help in surveying Minnesota soybean fields (suggested protocol below).

What is the soybean aphid? The soybean aphid is a small yellow-green to green aphid (pinhead size…much smaller than pea aphid or corn leaf aphid) with a pair of dark cornicles (abdominal projections) and a light cauda (tail projection). See pictures on one of the web sites listed below.



The aphid may be found on soybean stems and leaf petioles, young developing leaves (earlier in the season) and, later in the season, under leaves in the middle of the canopy.



What signs or symptoms do soybean aphids cause? Any aphid infestations produce "honey dew", the aphids attempt to excrete extra plant sap. Leaves with honey dew will glisten or take on a sooty appearance as molds grow on the plant sap. Light infestations may produce no visible symptoms. Plant symptoms under heavy infestations include a yellowing reminiscent of potassium deficiency (see photos on web sites), cupping of leaves and may even stunt the plant. Unfortunately many other factors may cause yellowing in soybean. John Wedberg reports that populations are collapsing in Wisconsin, but even if aphid numbers have dropped, shed skins, honey dew and sooty mold can still verify the presence of aphids.

Are infestations worth treating with insecticide? Infestations of soybean aphid are probably not worth treating this late in the season. Soybean aphid infestations tend to peak on younger soybean and decline as soybean development shifts from vegetative to reproductive development. No economic thresholds are available. Severe infestations in both Michigan and Wisconsin were treated in late July and early August; however, John Wedberg reports widespread collapse of Wisconsin populations.

What should I do if aphids are present? Fields with aphids should be reported immediately to Ken Ostlie, extension entomologist for corn and soybean, via telephone (612-624-7436), fax (612-625-5299), or email (ostli001@tc.umn.edu). Please include the following information:

1. Your name and contact information (address, office phone, cell phone)
2. Location of the field (county, township, section to nearest ¼, or GPS lat-long coordinates)
3. Farmer (operator)
4. Brief description of infestation, its position in field and on plants, and if plant symptoms are noted.

To provide more detailed information, consider following this protocol. Sample at least 10 plants per field with plants located at least 10 paces apart. Examine the entire plant for aphids. Record the number of plants infested and rate the abundance of the infestation on each plant as follows: 1 = light (only a few aphids present), 2 = moderate (aphids common on plant), 3 = heavy (plant inundated with aphids). Report % of plants infested and average rating.

If winged aphids are present, collect aphids into a small plastic bottle or vial, or send a leaf containing aphids. Be careful not to crush aphids. Mail the sample early in the week to the following address:

Department of Entomology
University of Minnesota
1980 Folwell Ave., Rm 219
St. Paul, MN 55108
Attention: Allyson Milles

Dave Ragsdale, our resident aphid specialist, is interested in initiating a colony to study these aphids further. If you have located an abundant source of aphids, consider sending a sample to Dave and Allyson at the above address. Call ahead to Dave (612-624-6771) or Allyson (612- 624-4718) to arrange shipment. Shipment should be overnight early in the week. Wrap the cut petioles of infested leaves in moist paper towels and place in zippered plastic bags labeled with collector and field location information. Ship to the above address.

Useful Websites, for more updates and info, by state:

FACT SHEET, Australia (Good photos and references)
http://www.agric.nsw.gov.au/Hort/ascu/insects/aglycin.htm

ILLINOIS: Article by Dr. Mike Gray, University of Illinois, August 16, 2000
http://www.ag.uiuc.edu/cespubs/pest/articles/200020h.html

MICHIGAN: Article by Dr. Chris DiFonzo, Michigan State University, August 17, 2000
http://www.msue.msu.edu/ipm/CAT00_field/FC08-17-00.htm#1

MINNESOTA: Article by Drs. Ken Ostlie & Bill Hutchison, University of Minnesota
http://www.vegedge.umn.edu/mnvegnew/vol2/818new.htm

WISCONSIN: Article by Dr. John Wedberg, University of Wisconsin, August 17, 2000
http://ipcm.wisc.edu/wcm/00-22insect1.html

Purple Flowered Thorns of the Prairie

Kevin Cavanaugh, Dept. of Agronomy & Plant Genetics

Numerous "purple flowered thorns," thistles, are show casing their colors during the late summer. Although many species were introduced to America, there are approximately 160 native species in North America, with at least 110 species north of Mexico.

The presence of thistles growing on agricultural land carries a dubious reputation that the landowner is being neglectful in caring for his land. This may be true for some of the invasive species, but for the majority of the native species this association in incorrect. Early settlers and Native Americans used many of the native species as a food source or for medicinal purposes. Many native bird species and insects also utilize thistles as a food source or to build nests. Native thistle species mentioned in this article are Flodman and Wavyleaf. Bull, Canada, Musk, and Plumeless thistle are all introduced species to North America.

Thistles can be troublesome weeds, especially following a cool wet summer and fall when seed production can be very high. Seed production from biennial thistles, such as Plumeless and Musk can reach 8,400 to 120,000 seeds per plant respectively. Biennial seeds tend to germinate in the summer or fall and the plant overwinters as a rosette. The following spring the rosette resumes growth developing tall stems and numerous large purple flowers and seeds. Biennial thistles tend to invade overgrazed pastures, undisturbed land, roadsides, and waste areas. Biennial thistles reproduce only by seeds whereas perennials, such as Canada thistle, reproduce by seed and rhizomes.

Canada thistle was introduced in North America as a seed contaminant in British and French colonies. It is found in Europe, North Africa, Central Asia, China and Japan. It grows best in the northern regions of the United States and southern Canada. Canada thistle is adaptable to a wide range of soil types, but its roots are able to penetrate great depths in clay and muck soils rather than sandy, gravel or limestone soils. Seed production from a Canada thistle can range from 40 to 80 seeds per head. The underground root system of Canada thistle can penetrate to a soil depth of 10 feet and grow laterally 12 to 15 feet per year! This is why control of Canada thistle can take many years if not aggressively managed in agricultural land when first observed.

Distinguishing the thistle species from one another can be done if one knows some of the unique characteristics of each species. Two tables are listed comparing the biennial and perennial thistles characteristics. In addition to the tables I have listed a few "quick to the eye" characteristics that can be helpful in rapidly identifying some of the thistles.

- Musk thistle rosette grows to more than two feet in diameter and has no pubescence on the underside of its leaves whereas, Plumeless thistle are often pubescent on the underside. Flower head of the Plumeless thistle gets so large that it causes the flower to nod, hence it's other name, Nodding thistle.
- Bull thistle leaves are double toothed with a sharp spine on the end of each lobe. Prickly hairs are located in leaf midvein on the upper surface and cottony hairs on the underside.
- Bull thistle usually grows singularly. It is found growing in pastures or wooded areas and has broad prickly wings on stems, plus it has dark purple veins on stem.
- Underside of Flodman thistle leaves are gray and highly pubescent and shiny green on top. The leaf lobes appear as "flipping upright" to help distinguish it from Wavyleaf.
- Wavyleaf has a gray cast in color and is spinier than Flodman.

Several excellent colored publications exist which are very helpful in identifying the thistles. I have listed some.

1. *Perennial and Biennial Thistle Control.* 1995. W-799. North Dakota State University Extension Service.
   The Thistles of North Dakota. 1996. W-1120. North Dakota State University Extension Service.
   These can be ordered by calling (701) 231-7882; www.ext.nodak.edu/extpubs.weeds.htm
2. *Weeds of Nebraska and the Great Plains.* Order by calling Nebraska Dept. of Agriculture at (402) 471-2394.
3. *Weeds of the West.* Order by calling Cooperative Extension Service of Wyoming at (307) 766-2115.

Thistle control options are too numerous to list in this article. One can refer to the *2000 Cultural and Chemical Weed Control in Field Crops* produced by the University

of Minnesota Extension Service. This publication is available for sale at county extension offices or it can be found on the Internet at:

http://www.extension.umn.edu/distribution/cropsystems/DC3157.html

See page 76 for perennial weed control. Biennial thistles do not survive well under cultivation due to tillage and competition from crops. Mowing plants before they flower does reduce the seed population, but several cuttings per year would be required due to the regrowth potential. Also mowing over time does reduce the root reserves. Cultural controls combined with chemical controls are more effective. If one wanted to be adventuresome, they could get a hold of a camel and see if they would graze the thistles to the ground. While living in North Africa, I did observe camels eat prickly pear as if it were cotton candy.

Biennial thistles

Plant Characteristic

	Flower	Leaves	Stems	Where Found
Bull	dark purple, disk-shaped; blooms July to September	alternate, double toothed lobed with spine on end; prickly hairs in leaf mid-vein on top, cottony below	tall, branched, winged stem that is pubescent; has dark purple veins	pastures, meadows; singular plants
Musk (Nodding)	rose-purple to white; heavy flower nods; brown bracts (pinecone like); 1½ to 3 in. diameter; blooms early June through August	alternate, coarsely toothed, extending down the stem; rosette leaves are usually smooth and lack pubescence; rosette 2-feet in diameter	erect with spiny wings, interrupted on stem; often grows in excess of 6 feet	pastures, meadows, waste areas,
Plumeless	purple, rarely white; short, very sharp spines on bracts; flower heads singular or clustered, 2-5; blooms late May to early July	alternate, deeply divided with alternate lobes; rosette leaves wavy and heavy pubescence on underside of leaves	erect, spiny wings run continuously on stem; candelabra look; reaches 1-4 feet in height	pastures, meadows, waste areas; grows in colonies

Perennial thistles

Plant Characteristic

	Flower	Leaves	Stems	Where Found
Canada	numerous, compact ¾ inch diameter, lavender, disk flowers; dioecious; flowers surrounded by bracts w/o spiny tips; blooms June to August	alternate, oblong, usually with crinkled and spiny edges; dark green leaves that vary in size	erect, branching above, ridged, w/o hair above, pubescent below; hollow; reaches 2-4 feet in height	cropland and noncropland; my neighbor

Flodman	reddish purple (rarely white); heads surrounded by bracts with small prickly leaves at base; bracts can be sticky; blooms mid-July through September	alternate with lobes at right angles; rosette light green to grayish on upper side, white with matted hair on lower side	erect, branched, matted hairs; 1-3 ½ feet in height	noncropland
Wavyleaf	deep purple to pink, rarely white; bracts are sticky and tipped with spines; flowers larger than Flodman	alternate, lobes tipped with yellow spines, hairy, and edges strongly wavy, more deeply lobed than Flodman thistle; rosette also wavy and gray in color	erect, sparingly branched above; nearly round, densely hairy; 1-3 ½ feet in height	more common in sagebrush land

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Water Use as Corn and Soybeans Mature

Jerry Wright, Extension Engineer, University of Minnesota Extension Service

As corn and soybeans near maturity, the daily crop water usage or ET becomes less that in the earlier portion of August and the soil water level in the active rooting zone can be allowed to decrease to greater limits without causing stress to the crop.

The table below lists estimated crop ET requirements between different growth stages and maturity for corn and soybeans under normal weather conditions in central Minnesota:

Stage of Crop Growth	**Days to Maturity**	**Inches of ET to Maturity**
CORN		
blister	45 - 50	7.0 - 7.5
milk	38 - 42	4.8 - 5.3
dough	30 - 35	3.2 - 3.6
first dent	23 - 27	2.1 - 2.4
full dent	19 - 21	1.6 - 1.8
½ milk line	12 - 14	0.9 - 1.2
1/4 milk line	6 - 8	0.4 - 0.6
SOYBEANS		
full flower	48 - 54	6.8 - 7.6
full pod	35 - 39	4.0 - 4.8
begin seed fill	27 - 31	2.7 - 3.3
full seed fill	16 - 18	1.1 - 1.4
begin maturity	9 - 11	0.4 - 0.7

When can Irrigation Stop on Corn and Soybeans

Jerry Wright, Extension Engineer, University of Minnesota Extension Service

As irrigated corn and soybeans near maturity, the soil water level in the active rooting zone can be allowed to decrease to greater limits without causing stress to the crop.

For irrigated corn starting to dent, research has shown that the soil water deficit can be allowed to increase to 60-65 percent by maturity time without reducing yields in most years.

Generally a corn crop will need 2 to 2.5 inches of additional ET after first dent to come to full maturity. For soils holding at least 3.5 inches of available water at first dent there should be no additional irrigation needed if temperatures remain at or below normal. Lighter soils may need one or two more irrigations while a heavier soil may tolerate even an earlier cutoff time.

For irrigated soybeans, once the upper pods start to fill, the soil water status can also be allowed to become drier, so that by maturity the soil water deficit is near 50-60 percent of field capacity.

Managing this expanded soil water deficit near maturity may reduce irrigation needs by 1 to 3 inches per acre. This reduces pumping costs and conserves the water supply.

More information on irrigation water management is discussed in University of Minnesota Extension Service bulletin "Irrigation Scheduling by the Checkbook Method" AG-FO-1322. This bulletin can be order over the internet at http://www.extension.umn.edu/units/dc/catalog.html or at any county extension office.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

<u>If Starch is Frosting the Top of Your Kernels, You have Your Number</u>

About five weeks after silking, corn should be entering the R5 stage or the dent phase. Nearly all the kernels should be dented or are denting. Colored cobs on ears that are not white cobs should now be a bright red. Corn kernels are drying and the starch accumulation can be seen as a small, hard white layer at the top of each kernel. This "white line" should be visible shortly after denting and this line will move down toward the kernel tip with maturity. Stresses to the corn plant at this time can reduce kernel weight but not kernel number. Kernel moisture content is about 55% at this time. A hard frost at this time could cause premature black layer formation, cutting yields and delaying harvest as frost-damaged ears are slower to dry. By the time dented corn is at 50% moisture, a frost injury yield reduction will be only 10-20%. At mid-dent or half-way through this stage, kernel moisture will be about 40% and yield reduction from frost will be only 4-5%. Yield gain from this point on is merely frosting on the cake!

<u>Optimizing Yield with Late-Season Drought</u>

Late-season drought is the primary limiting factor for corn and soybeans in the High Plains. Drought during flowering decreases flower and then seed number per unit area. Corn reacts by a delay in silk emergence relative to pollen shed and an increase in seed abortion. Soybeans will increase pod abortion.

Drought sensitivity decreases as seeds mature; however, drought during seed filling in both crops can shorten the duration of seed filling resulting in the potential for less yield and smaller seed. In corn, the shorter filling period is caused by premature water loss from the seed. At the twelfth-leaf to dough stage in corn, the management allowable soil water depletion (MAD) in the root zone should not exceed 50% and from dough to maturity the MAD should not exceed 60-70% or yield can be reduced by up to 11.5 bushel per acre-inch in water deficit. In soybeans, growth stages from first flower to first pod should maintain a MAD below 60-65% and during first pod through to maturity the MAD should be below 60-70% or a yield reduction can occur. Drought stresses in later pod-filling stages in soybean result in a decrease in maximum seed volume.

Ideally, soybeans flourish at temperatures of 86F (and corn up to this temperature or to a little lower at 84F). Temperatures at 95F with low humidity and the onset of droughty soil conditions can limit yields in fields. Drought symptoms in either crop show leaf wilting and darkening (or leaf rolling before mid-morning in corn) and reduced plant growth. Soybeans grown in dry soils

can reduce nodule formation, development and later nitrogen-fixation early in plant growth and these symptoms can also appear later when soil temperatures reach greater than 90F for several days. Yield loss in either corn or soybeans will ultimately depend on original planting date (good, early growth can push crops through drought spells better), the maturity group "fit" for the region and how long the drought persists.

In corn, selecting hybrids with rapid ear growth, tolerance to high population densities and prolific hybrids can improve performance under drought conditions. In soybeans, varieties that show tolerance to very high (or very low) soil pH, tolerance to nematodes in areas where cyst nematodes exist, and tolerance to any commonly occurring pests allow the crop to withstand drought effects.

Also, less environmental stress from restricted root growth due to poor drainage, nutrient imbalances and soil compaction (hardpan) will help the plants combat drought.

During the soybean stages R6 to R8 (full size beans up to maturity), the plants are accumulating dry matter in the seeds. The dry matter is accumulated at a rate of about 1 to 1.5 bushels per day during R6 to R8. Thus, stress during seed filling in soybeans can affect yields up to that 1.5 bushel per day, depending on how the temperature and drought ultimately affect the rate and the length of time dry matter accumulation can occur.

Check fields now for your most productive hybrids and varieties and keep in mind that the best fields should be those that: have the most productive soils; are fields where crop rotation is practiced; utilize deep tillage if compaction was a concern; use disease-resistant varieties; are planted with water-conservation practices in mind; may have been drilled, in the case of soybeans; were planted for optimum population for the field; have varieties selected within the range of maturities for the region; use integrated pest management systems; and, practice sound insect and weed management.

Don't let the Rust Rain on Your Parade

Common maize rust is showing up in corn fields with recent rains and higher humidity along with the cooler temperatures that make conditions ripe for the leaf and husk disease. In hybrid fields, the fungal disease rarely is serious enough to require control but hybrids do vary in resistance. On the other hand, seed fields are often scouted and chlorothalonil, copper salt, mancozeb or propiconazole fungicides have been used but the first three have only protective activity and use of all fungicides after detasseling usually results in an unprofitable fungicide application. To determine if rust is creeping into your fields, look for pustules on the leaves or husks that are red, later turning to black with winter. Rust does not usually survive winter but returns to the region as the spores are blown up from the south. However, if infestations are seen in fields remember to try to rotate that field following the disease. Check now on the susceptibility of your corn to the disease and if the disease is showing up, look for hybrids that are less susceptible for future plantings. The disease often first shows up at the V6 to V8 stages of corn and the fungus can be scouted every one to two weeks during the season depending on weather conditions. Remember rust usually is not a great concern in hybrid fields, however, use scouting to find hybrids with the most resistance to the disease for future corn production.

Review the Results of Your Season.

Now that you are beginning to get out in the fields and estimate yields, review the factors that influence yield. Compare your ideas on the season with resulting yields at harvest end. Use of yield monitors on combines definitely show the variability that exists throughout a field. Several university and industry specialists compiled a listing of yield factors from most important to least that may catch your eye. Ask yourself if any of the following factors influenced your crops this year:

1. drainage (and associated soil moisture and stresses)
2. crop variety (including disease resistance, ability to adapt, maturity for the season)
3. insect or seed problems
4. crop rotation
5. tillage (was it the right use, timing and done under the correct soil moisture conditions)
6. compaction
7. pH
8. herbicides (including correct choice, misapplication and drift)
9. subsoil conditions (this is a catch-all factor of acid or alkaline subsoil, clay layer or fragipan)
10. fertility placement (including any nutrient deficiencies)

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 20 **www.extension.umn.edu** **August 11, 2000**

In This Issue

New Requirement for Minnesota Farmers Who Fumigate Stored Grain

Dean Herzfeld, Coordinator/Associate Professor

The Minnesota Department of Agriculture (MDA) in conjunction with the University of Minnesota Extension Service, has hired Nathan Dyrud as an Agricultural Specialist to write the new Private Fumigation Manual and Exam for farmers who fumigate their own on-farm stored grain. The requirements for farmers who fumigate to take a monitored fumigation exam will be implemented on January 1, 2001. Farmers will need to have their Private Pesticide Applicator Certification as well as a Fumigation Endorsement on that Certification if they wish to purchase and use fumigants in the state of Minnesota. The new manual and more information on the endorsement process will become available later this fall through county extension offices around the state.

This is a cooperative effort between the MDA and the University of Minnesota Extension Service. The new requirements are an outgrowth of recommendations developed over the past three years by the Pesticide Applicator Education and Examination Review Board that advises the MDA and the Minnesota's Pesticide Applicator Training program. This advisory board is made up of farmers, representatives of agriculture industry, advocacy organizations, state agencies, and the MDA and Extension staff. Its goal is to create common sense recommendations for pesticide education and training in Minnesota. The recommendations of the board were approved by the Commissioner of Agriculture to enhance the training of farmers for on-farm stored grain fumigant usage.

Over the next few months, Dyrud will be located at the University of Minnesota Campus in St. Paul, compiling, writing, and editing the latest information available on fumigants used by farmers in stored grain management. Any comments, suggestions, or questions about the development of this project should be directed to him at (612)624-2705, or by e-mail at nathan.dyrud@state.mn.us Questions or comments about the implementation of these requirements should be directed to Dean Herzfeld, the extension PAT Coordinator, at (612)624-3477, or Rick Hansen, Supervisor of the MDA's Certification and Information Unit, at (651)297-7175.

Farmers Need Temporary Grain Storage Information - Again

Bill Wilcke, Minnesota Extension Engineer

With a lot of grain carried over from last year, good-looking crops in the fields, and very low grain prices, many farmers are once again looking for information on temporary grain storage. Farmers will not be interested in spending much money to store crops that have such low value, so we need to come up with inexpensive storage methods that are inexpensive but still protect crops from excessive quality loss.

We've created a temporary grain storage website in an attempt to assemble articles, bulletins, presentations, and links to other websites that might be useful to farmers, educators, and agribusiness personnel. The information is posted on the University of Minnesota Biosystems and Agricultural Engineering (BioAgEng) Department website at: http://www.bae.umn.edu/extens/postharvest/tempstor.html

The website includes articles on the following topics:
* Calculating Bushels
* Converting Tower Silos for Dry Grain Storage
* On-Farm Grain Storage Costs: Consider all the Factors
* Temporary Grain Storage Ideas
* Using Flat Buildings for Dry Grain Storage

In addition, the website includes access to the text of the following Extension bulletins:
* Management of Stored Grain with Aeration, FO-1327 (U of M)
* Selecting Fans and Determining Airflow for Crop Drying, Cooling, and Storage, FO-5716 (U of M)
* Temporary Grain Storage, AE-84 (NDSU)

The website also provides access to a PowerPoint presentation on temporary grain storage that can be viewed online or downloaded, and access to the FANS computer program, which can be downloaded and used to select fans for grain bins. The site also features links to several other universities and to the USDA Farm Service Agency (FSA). The FSA website contains information on their low-interest loan program for new grain storage facilities.

If you don't have access to the WorldWideWeb, or if the materials listed on the website don't answer all of your questions, feel free to contact Bill Wilcke in the BioAgEng Department at wilck001@umn.edu or 612-625-8205.

Nutrient Management Plans in our Future

George Rehm, Extension Soil Scientist

Recently, the phrase, "Nutrient Management Plans" has entered the conversations of those who work with nutrient applications for Minnesota crops. There's a lot of confusion and many unanswered questions. Perhaps, it's time to briefly discuss what we know and what we don't know in Minnesota at this point in time.

At the national level, the USDA and EPA have prepared a unified national strategy to minimize the water quality and public health impacts of animal feeding operations (AFOs). This unified strategy is a consequence of the signing of the Clean Water Action Plan in 1998.

The unified national strategy is a general plan with several guiding principles. The specific of the unified national strategy, however, have not been put in place at the state or local level. It seems certain that several state agencies will be involved in the development of nutrient management plans. However, the specific task or role of each agency has not been defined in Minnesota.

As yet, there are no specific regulations that pertain to nutrient management plans. At the present time, it appears that there will be considerable emphasis on voluntary actions by owners or managers of animal feeding operations. The size of the feeding operation will probably affect the type of nutrient management plan that is needed to satisfy the national strategy. The Comprehensive Nutrient Management Plan (CNMP) will be needed if feeding operations have a size of 1,000 animal units or larger. Smaller feeding operations will probably not need a CNMP; but, some plan or record-keeping system will be needed.

As might be expected, the CNMP is more complex than a "nutrient management plan" that would be appropriate for smaller feeding operations. Regardless of the plan needed, the

specific content has not yet been identified.

There is the anticipation or expectation that several individuals or groups of individuals will be involved in writing plans. This raises the issue of certification. The certification process or system has not been defined. Considerable discussion has focused on this issue for some time. It's safe to say that the state agencies in Minnesota have not agreed on a certification policy for those who are expected to write nutrient management plans.

Ag professionals as well as farmers who might be expected to write the various management plans in Minnesota can expect that there will be considerable emphasis on educational programs. In general, the content of these programs has not been clearly defined. Considering the general confusion that surrounds nutrient management plans, it may be premature to get excited about nutrient management plan educational programs. There will be ample opportunity to participate in educational activities after specific guidelines for the content of the plans and the certification process have been put in place.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Quick Queries on Corn

1. Thinking about areas that I plan to plant corn next year, should areas where compaction problems showed up in fields this year be chiseled?

Subsoiling can reduce the soil compaction that has been created in the fields if the tillage is done when the soil is dry. Tillage done now or later in the fall should shatter the soil so that compaction is then only limited. A winter with much freezing and thawing can also help alleviate some problems with compaction, but remember that the winter must have several thawing-freezing cycles occur in order to create any breakup of compacted soil.

2. What causes corn plants to create an ear on top of the plant (where the tassel is)?

Crop genetics along with high fertility can cause ear development in the tassel. Also, hail or mechanical damage during early plant development may show more tassel ears! High light conditions on the right genetics can also reveal this trait. However, yields shouldn't decrease on these unusual plants.

3. What causes corn plants to create multiple ears at one node?

This again is caused by crop genetics, high fertility, and ample light. Lower populations within the field may also help reveal this unusual trait. Occurring more in certain sweet corn lines than in regular, yellow field corn, this trait rarely has more than the dominant ear show substantial yield. And, if conditions are good, the dominant ear will not show yield decreases! Usually the side ears are barren, have only a few kernels or may have other problems such as silk balling or lack of sync with the timing of tassel pollination. Multiple ears where all the ears are clustered together within individual as well as enfolding husks can create other problems. The structure can hold water and lead to the development of ear diseases or may be more attractive to insects that feed on ear silks. It is rare to find this trait encouraged in corn lines, however, it does exist. Hopefully, this trait will be mapped and held for possible use in the future. If plant development could be speeded up and multiple ears are produced without problems, wow what a yield potential!

4. What causes corn smut in fields?

Common smut is caused by disease introduction through early, vigorously growing, wounded plant tissue under the correct weather conditions (no consensus but rainy, humid weather is generally critical for infection). Resistant corn hybrids do exist and some studies indicate that resistant lines could be selected by evaluating the progeny of developmental materials test-crossed with susceptible varieties. However, incidence is usually low and sporadic. Often tillers show more problems with smut than main corn plants.

Progress on Plants Shown by Stability

A recent study by Canada from the Eastern Cereal and Oilseed Research Center has shown that soybean varieties have improved and are more efficient at establishing, supporting and filling seeds on a per-plant basis than older cultivars. The research used fourteen cultivars that represented seven decades of breeding and selection (1934-1992). On the average, the yield progress for short-season soybean has been about 0.5 percent per year since the early 1930s. The increase in seed yield with year of release was directly associated with an increase in the number of seeds produced per plant. Seed protein concentration tended to decrease but seed oil concentration increased over time. Even more important, the newer varieties are phenotypically more stable (less lodging) than the older cultivars. Also, two years of the data showed that foliar disease tolerance has also improved over time.

Full Pod Stage in Soybeans will Benefit from Recent Moisture

Full pod or stage R4 in soybeans is shown by rapid pod growth and the beginning of seed development on the plant. Most notable will be the pods on the lower nodes that are nearly full size. The last of the flowering on the plant (on the stem tip) will occur during this stage of growth. From R4 to R5.5,

soybeans will rapidly accumulate dry weight. R4 begins the most crucial growth period for seed yield and the recent rainfall will supplement the soybean plant needs. Besides moisture, temperature, light, nutrients, lodging or any hail stress during R4 to R6 will cause more yield reduction than any other time on soybeans as flowering is essentially complete and young pods or seeds abort more readily under stress. Ultimate seed size can be larger (limited only by variety genetics) if conditions continue as seen now into soybean maturity.

Corn is Coursing through Crucial Corridor of Development

About three to four weeks after silking, corn enters stage R4, the dough stage. During this stage, the starch accumulation slowly thickens the contents of each kernel and moisture content begins to decrease. Most notable is the cob coloring during this development phase. It is at this time that cob color changes to become pink to light red on many hybrids, but on other "white cob" types may stay very similar in color to earlier stages. Excellent weather with timely rains has given corn almost perfect conditions in many fields during critical stages following silking. Continued good weather will help yield and will limit unfilled kernels and chaffy ears that otherwise occur during unfavorable environmental conditions or when nutrient deficiencies occur. Entering the dough stage, corn will have accumulated 50% of its dry weight and will have about 70% moisture, making any unforeseen frost at the end of this stage reduce yield 35 to 50%. However, once entering R5, the dent stage, yield reduction from an early frost is significantly reduced. Watch fields for any top kill on the plants which heralds unwanted anthracnose (stalk rot) or may signal extensive tunneling from corn borers, indicating a need for harvesting as early as possible to avoid lodged plants.

Common Ragweed Keeps Coming

The annual weed known as common ragweed is one of the most adaptable weeds known as it has protection strategies to keep on growing. It reproduces by seed (one plant can produce around 3,380 seed that are mature, many more are immature). Germination is greater with temperature alternations but the seed has a limited dormancy if conditions are ripe for seed germination. The plant is unpalatable to livestock, however, the numerous seed can be consumed and carried to other locations by wild turkey, pheasants, quail, sparrows and other birds as well as small mammals. Ironically, treatment but not control of the plants with the herbicide 2,4-D was found to make the plants more palatable, however, it also increased the weeds' ability to accumulate nitrates. Recently emerged plants are shorter and quickly produce inflorescences that then quickly go to seed. Able to hasten seed production later in the season, this weed was built to stay around. Its pollen can also cause hay fever in August and September, adding to its nuisance qualities. Control this weed as much as possible but be aware it is a smart weed with a will to survive

Multiple-Ear Indicator Relates to the Hybrid and the Environment

Corn plants that show multiple ears are telling you that the season is going well and at the same time are revealing something about their genetic background. Hybrids that have more than one ear develop into a grain yield have the advantage of genetics and the environmental combination of good fertility and moisture.

Corn has the potential for developing ears at each joint of the stalk up to the top or major ear. In some varieties, silks may actually appear on the second and third ear shoots. Generally, the silks on these shoots appear too late for pollination and barrenness results. Some second ears may be produced under excellent growing conditions and sometimes at plant densities below recommended levels (hopefully, this year is one of those years of excellent growing conditions!) Corn hybrids grown in the north-central Corn Belt (and those grown in our Valley region) usually only produce one ear per stalk. Most plants today produce single ears because most of the varieties have been selected over many years to produce only one harvestable ear!

Before harvesting was mechanized, farmers found it was more convenient to harvest one large ear from a plant rather than several smaller ears. Seed for planting usually also came from single-ear plants (and these large, single eared plants usually won the crop judging shows!).

Although researchers examine the multiple-eared corn, the research still lags behind the changes in harvesting and growing ideas. Also, the multiple-eared varieties appear to produce the second or even more rarely the third ear only under rather good fertility and moisture conditions. However, often the prolific types (multiple ears) have shown to have more consistent yields than single-ear types. Hybrids capable to producing more than one ear often can better adjust to available moisture and fertility (the ultimate ear flex!).

In fact, some studies have shown that the two-eared varieties have less of a tendency to go barren at higher plant populations! Multiple-eared hybrids could stabilize yields by: minimizing barrenness at high plant populations and by compensating for reduced stands by producing two or more ears per plant. And, we are slowly seeing the results of some of the expanded research using the multiple-eared hybrids...more so in some areas than others.

The cornnut industry really expanded into the breeding of multiple-ear hybrids several years ago. They still wanted the larger kernels but found that the corn plants with multiple ears tended to compensate better under different environmental conditions (they also looked into the more upright leaf structured hybrids that tend to be more efficient at utilizing light derived plant energy, too). But, until more breeding efforts expand and bring up the older plant genetics to current yield standards while maintaining stalk strength, we continue to see more one-eared hybrids in fields.

Hailed Soybeans May Compensate But Watch for Disease

Yield loss in soybeans is determined on the stage of growth of the soybeans at the time of damage and the degree of plant damage. Damage can be due to leaf defoliation, stand reduction, stem damage and pod damage. The calendar date and pest control later also affect ultimate yield.

Check stands 7-10 days after a storm to determine the stand reduction. Determine the current stand versus the original stand. Count these losses as total losses if the plants are totally damaged below the cotyledons. Shredded or cut stems may lead to bruised plant stems. Mild bruising may only break in the outer stem tissue but severe bruising may expose the central stem tissue and lead to more loses. Unfortunately, bruised stems that recover may break any time before harvest as they are weakened. They may lodge and make harvest very difficult. It is very difficult to determine yield loss from bruised plants until harvest.

Defoliation is a measure of the leaf area destroyed by the storm. Leaf loss on soybeans during vegetative stages has little effect on yield (if only the leaves are shredded); however, defoliation during reproductive stages does affect yield. Added damage to stems and branches may also decrease yields more, depending on how the weather progresses during the remainder of the season and if additional disease or insect damage results on damaged soybeans. The further along in maturity a soybean plant is, the more effect on yield.

Growth Stage	% Defoliation				
	10	40	60	80	100
	% Yield Loss (estimated--with no flower/pod loss)				
R1-R2	0	5	7	12	23
R3	2	6	11	18	33

Loss of excess flowers beyond the normal losses on soybeans or losses of pods may increase yield losses.

Hope No Hail for Now, Hail on Corn Effects Estimated by Leaves

Corn is in the stage when you want the least amount of plant stress as possible. Estimated corn grain yield loss due to defoliation in corn can give you an idea of where your corn crop is in areas where hail hits. Total corn loss from hail damage is estimated by adding the expected yield loss caused by stand reduction, the expected loss caused by defoliation and the expected loss caused by direct ear damage. This, however, is only an estimate of the percent yield loss. Unfavorable weather later in the season can cause yields to be lower than expected or favorable weather can cause yield increases.

Growth Stage	% Leaf Defoliation				
	10	40	60	80	100
	% Yield Loss				
Later leaf stages					
prior to tasseling	3	18	38	64	96
At tasseling	3	21	42	68	100
Silking	3	20	39	65	97
Silks brown	2	18	36	60	90
Pre-blister	2	16	32	54	81
Blister	2	16	30	50	73

Estimate Corn Yields in Your Fields

With silking finished on corn that is progressing in a timely fashion in order to mature before the average frost date, estimates of the relative grain yield can be done. First, count the number of harvestable ears per 1/1000th of an acre. With 30-inch rows that is a row length of 17 feet, 5 inches and with 22-inch rows count the number of ears down 23 feet, 9 inches of a row to determine the estimate. Within this ear count area, also count the number of kernel rows on the ears of every fifth plant. Also, count the number of kernels per row on these same ears. Remember to only count kernels that are developing well (do not count kernels on the tip that are less than half the size of those mid-way up the ear). Average the total number of ear rows counted within the area, then separately average the total number of kernels per row within the area. If possible, move to various areas of the field and repeat the above estimations and average your findings. Next use the following formula to determine yield:

[(average ear #) x (average row #) x (average kernel #)] / 90 = bushels per acre

Remember, this estimate of relative grain yield will be underestimated in a year with good grain fill conditions.

Common Weed on the Lamb this Year

One of the weeds that seem to be getting more and more elusive to herbicides is common lambsquarters. This annual weed can flower any time between June and September and will set the individual one-seeded fruit within clusters in dense spikes on terminal or axillary inflorescences. The tiny, black or brown, shiny seed (around 72,450 per plant) are creative, smart, proliferation capsules as they are polymorphic (exhibit different dormancy states). The black seeds require some cold or other dormancy breaking treatment to germinate but the brown seed require only water, oxygen and a suitable temperature for germination (hence some of the multiple flushes seen this year). In fact, seed germination is enhanced as the seeds age (even after 38 years, 7% of lambsquarters seed have been found to germinate; a 26 year study found most of the seed viable). The minimum temperature for common lambsquarters germination is 36F and the maximum generally is around 95F. The optimum for a real flush of plants is around 68F. Alternating temperatures actually promote more germination (as seen this year) and the manner in which light affects germination varies by seed age, genotype, nitrate availability and temperature. Many varieties of lambsquarters exist. Check the leaf shapes and inflorescences to determine what you have. The plant is

highly variable and may be simply a group of many different, but similar species (inclusion of the pitseed goosefoot occurred for many years under the guise common lambsquarters) such as the family relation of the mapleleaf goosefoot. The taproot on the plant can easily branch allowing this adaptable weed to proliferate even under the heat. Also look for red or light green striations on the stems that occasionally occur with this weed, very similar to another, further removed, family relation in the Goosefoot family (Chenopodiaceae), the kochia. This weed easily bides its time underground, waiting patiently until tillage pulls the small seed up to the surface for germination. If common lambsquarters is running you ragged on fields this year, make sure a comprehensive management plan and rotation is in the plans for next year.

Beginning Pod Stage on Soybeans are a Favorite for Deer

Beginning pod (stage R3) in soybeans starts once one pod upon one of the four uppermost nodes (with a fully developed leaf) on the main stem reaches 3/16th of an inch long. With an adequate plant population, the soybean crop now has yield dependent on the total number of pods developed, bean number per pod and seed size. Extreme temperature or moisture stress can affect all of these yield components. Favorable growth conditions now for soybeans will encourage a greater pod number per plant, thus increasing yield. Total bean number per pod and seed size while influenced by environmental conditions are also greatly regulated by genetics. Even early-season stresses now followed by favorable conditions can result in more seeds per pod as well as a larger seed size as dictated by the variety. Soybean disease is remaining low due to excellent drying conditions for the past few weeks and current short showers that are occurring right when needed through most of the Valley. Watch for insect pests or damage from wildlife feeding. Deer are often very selective in the soybean variety they choose to graze!

Bacterial Blight Taking a Bite?

The most common bacterial disease of soybean, especially during cool, wet weather, is bacterial blight. Yield losses from 4-40 percent have been reported in the U.S., but losses are generally low on the resistant or tolerant species currently grown. Growth of this disease is quickly checked with hot, dry weather. Blight lesions, starting on the lower leaves but moving up the plant and even onto stems, petioles and pods look like light brown spots on the leaves. Strains of this same bacterium can also infect most other beans besides soybeans. Rainstorms bounce the bacterium upon the plant and the disease enters through the stomata. Multiplying within the intercellular spaces of the mesophyll on the leaves, the disease produces a toxin that can inhibit chlorophyll synthesis. Generally soybean varieties are less susceptible than other beans and will have little damage to yield unless continued rainy, cool weather promotes the disease. With the current weather hot and dry, look for soybeans to drop the bottom, affected leaves and spring into green growth with healthy plants during flowering and beginning pod set. Jot a note on fields where bacterial blight was seen this year and remember to rotate fields to crops not susceptible to the disease and to plow under residue from severely affected fields this fall.

Plant Disease Clinic

Sandra Gould, Assistant Scientist - Plant Pathology

Samples submitted to the Plant Disease Clinic in July included:

soybean-*Fusarium* sp, *Pythium* sp & *Rhizoctonia* sp root rot, *Phomopsis* sp stem canker, SCN on roots, *Colletotrichum* sp (anthracnose), Fe chlorosis, herbicide damage to Agronomy
wheat-black chaff, cultured for grain storage molds
feed,hay,& silage- cultured for storage molds
kidney bean-bacterial leaf spot, *Colletotrichum* sp (anthracnose)
oak-oak wilt, anthracnose
elm-Dutch elm disease
catalpa-*Verticillium* sp wilt
apple-fire blight
juniper-*Kabatina* sp tip blight
barberry-bacterial leaf spot
lilac-*Rhizoctonia* sp & *Phytophthora* sp root and stem rot
currant-*Phytophthora* sp root rot
Astilbe-*Pythium* sp root rot
Asclepias-bacterial leaf spot
Hosta-tobacco rattle virus
Cimicifuga-*Rhizoctonia* sp root rot, *Colletotrichum* sp stem rot
C. cactus-*Cercospora* sp leaf spot
larkspur-*Phythium* sp root rot
turf-*Pythium* sp, *Drechslera* sp & *Colletotrichum* sp
raspberry-cultural to Horticulture
tomato-*Fulvia* sp (leaf mold)

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In This Issue

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Soybeans can Still be Sapped by Late-Season Diseases

The most common diseases seen in soybeans usually occur during the VE to V4 stages; however, plant pathogenic fungi can infect later or latent symptoms may cause plant decline during the reproductive growth stages. Premature decline of soybean foliage or stems from R1 to R7 will usually reveal any of these late-appearing symptoms. Rhizoctonia can still appear on plants during these late stages. In older soybean plants, check for root rot to see if Rhizoctonia is present. Also, fields that have had multiple years of soybeans may show brown stem rot. Wilt, chlorosis, curling and eventually necrosis of leaves may be brown stem rot. Split an infected plant and check for internal browning of the stems which heralds the presence of the disease. Stem browning can eventually progress to the top of the stem. Usually foliar symptoms do not appear until August to September. Many times, brown stem rot is simply confused with early maturity. White mold or sclerotinia stem rot will not appear until two weeks or more after soybean flowering. Wet, cool weather favors white mold which appears first with chlorosis of leaves, later gray-green coloring to the leaves and much later white, fluffy mold appears. Optimal to excess soil moisture favor development of Rhizoctonia, brown stem rot or white mold. With these diseases, tolerant/resistant varieties stop disease progression. Also, crop rotation to nonhost crops to these diseases can limit soybean disease development.

Pucker Perfidy Promotes Problem Proofing

Late-season soybean leaf cupping or wrinkling is usually observed in several different areas each year. A number of factors, unfortunately, can contribute to the cause. Herbicides are often blamed but are not

always the problem! Soybean variety, environmental conditions (such as hot or cold with humid weather), nutrient deficiencies (especially in combination with weather), soybean plant viruses (such as soybean dwarf virus, soybean chlorotic mottle virus or the exotic soybean crinkle leaf virus) and insects (particularly leafhoppers, spider mites and aphids) can also cause leaf puckering in soybeans. Also, a mixture of several of these possible culprits can bring about symptoms that can look bad, but may not be yield limiting. Puckering of leaves occasionally is seen in Roundup-Ready soybeans following application of Roundup. Fields previously treated with Raptor, Pursuit, Classic or Pinnacle have also been seen to leaf pucker. Metabolism of postemergence herbicides, especially under humid weather conditions, may contribute to some minor terminal bud injury on soybeans that alters plant hormone distribution and/or redistribution so that new shoots below the "injured" zone take on a more bushy appearance with the leaves appearing wrinkled or cupped. These symptoms often take on the appearance of injury that is similar to light drift from a plant growth regulator such as 2,4-D (phenoxy-carboxylic acids), Banvel, Clarity, Distinct (dicamba--benzoic acids) or Stinger, Curtail, Scorpion III, Accent Gold (clopyralids). Carefully observe the soybeans affected with leaf puckering, note the field pattern, timing, and other field conditions as well as the herbicides being used on surrounding fields before deciding on the pucker problem.

Pod Abortion in Soybeans Isn't Always Abnormal

With soybean plants beginning the pod stage, the developing pods will first be noticed on the lower nodes where flowering first began. Temperature or moisture stress can limit the number of pods that develop. However, under normal conditions, the soybean plant has only 25 to 40% of its flowers develop into mature pods. Half of the loss is from flower abortion while the other half is due to natural pod abortion. Surplus flower and pod production during the R1 to R5 stages in soybeans provides the plant with more latitude against stresses in the field. Practices such as early "pop-up" fertilization, narrow rows, proper plant populations, weed control and irrigation can all reduce flower and pod abortion and increase soybean seed yields. Stress to soybean plants between the R4 and R6 stages will cause more yield reduction than at any other time because flowering is complete and young pods and seeds will abort more readily.

Humidity Hosts Hazards to Corn

With the high humidity conditions this year, watch out for certain diseases that might be lurking in your fields. Anthracnose, a fungal pathogen that infects corn, sorghum and small grains, survives in diseased leaves and stalks and produces spores during warm and humid weather conditions. The disease starts as small, oval to elongate water-soaked spots on the leaves and internally it can decay stalk tissue. It is favored by warm temperatures (70-80 F) and extended periods of cloudy, humid weather. Foliage and stalk wetness are important for infection that can occur throughout the season. Northern corn leaf blight is a fungus which first appears on the lower leaves. Spots are grayish-green or tan. Incidence is found in humid areas with temperatures from 65 to 80 F with heavy dews optimal for disease development. Northern leaf spot is another fungus that can increase with moderate temperatures and high relative humidity. Symptoms are narrow linear lesions up to one inch long that can be circular, giving a bead-like appearance. Corn hybrids differ in susceptibility to each of these three diseases, so hybrid selection is important in avoiding these diseases. Also, cultural practices such as crop rotation and residue management are important.

Ground Ivy Cool Cover for Hot Drink

The weed known as ground ivy, also as gill-over-the-ground, creeping Charlie and haymaids, is another perennial that reproduces by creeping stems and seeds. These stolens can extend over two feet long if allowed to grow. The leaves on the weed are opposite and kidney-shaped and may grow only a little bigger than an inch in diameter and if the foliage is crushed, the plant may exude a faint minty odor. The flowers are small and may be a light blue to bluish-purple corolla (rarely white in color). Once pollinated, the weed sets fruit that are nutlets in groups of four that has one seed in each nutlet. This weed quickly forms a ground cover but is only shallowly rooted. It likes shaded, moist soils and is

commonly an urban dweller as well as being found on hillsides, pastures and along streams. Historically, this weed was used in Europe as a tonic, astringent and diuretic and ironically, before hops were widely used, leaves of the ground ivy were steeped in hot beer to clarify it and improve flavor. Germinating when temperatures are around 59-68F, watch for a new flush of this weed with the recent cool night temperatures. Germination is better with some light and after only a month following seed production due to a short seed dormancy.

Did the Cool Nights Tie You in Knots?

Last week's very cool night temperatures may have affected more than your sleeping at night. Corn that was rapidly growing through the Red River Valley the previous two weeks was suddenly clipped in progress by the low temperatures. Temperatures that dipped below 50F may have halted the corn in mid-growth spurt, enough to tie up the corn in knots. In other words, corn that was very rapidly growing may now be showing signs of tassel tie up, otherwise known as tightly wrapped leaves around the tassel. Compare the dates of herbicide application, any stresses (continued water-logging, drought, insects, diseases) and temperatures around the time that any leaf tie up appeared. More than likely, the corn that was just starting to tassel may have put the whoa on the grow button and tied up the leaves around the tassel. Warm temperatures this weekend as well as through this week should have you seeing the grow button back on GO. While scouting, check your field notes on the corn that showed tassel tie up. See if this corn was one of your quick growing hybrids just prior to the cool nights. Put a star by those hybrids that come out of or never show tassel tie up in the next four to five days to remind yourself that these may be keepers. Usually, tassel tie up due to cool temperatures are not cries for concern. No yield loss should result from tassel tie up and pollination should proceed normally. If it doesn't, highlight these hybrids in your handbook as only maybes for next year.

Separating "Cockles and Mussels"

Kevin Cavanaugh, Dept. of Agronomy & Plant Genetics

The title of this article would be applicable for the shopper at a fresh seafood market searching for some tasty ingredients for a seafood jambalaya. However, I am subjecting the readers to the "bait and switch" routine borrowing this partial phrase from an old Irish tune. Distinguishing the many Cockle weed species can be challenging due to their similarities. Below is a table of several species of the Pink Family or Caryophyllaceae. Another common weed member of this family that many people recognize is Chickweed. All of the species listed in the table are flowering throughout Minnesota at this time, so observing their characteristics and distinguishing what species you have is easier than when they were still in vegetative stages.

Characteristic	White Cockle	Bladder Companion	Nightflowering Catchfly
growth	biennial; short-lived perennial	perennial	annual
stem	erect, branched, hairy, sticky; 1to 2.5 ft	tall, smooth, sprawling at base; 1 to 1.5 ft	erect, densely covered with sticky hairs; 1 to 3 feet
leaves	opposite, long and narrow; not petioled, covered with hair; pointed at tip	opposite, elliptical, smooth-edged, not hairy	oblong, 2-5 inches, smooth-edged
flower	white to pink; 3/4 in diameter with 5 notched petals; borne on erect stems or loose panicles; open in evening; male and female flowers on separate plants	white, 1-inch wide with 5 notched petals borne in loose panicles, often drooping	white to pink; 3/4 inch across with 5 notched petals
seed pod	swollen, ovoid with 10 short teeth at top in hairy inflated calyx*;	enclosed by thin inflated 5 toothed calyx	enclosed by a calyx with 5 teeth
seeds	flat, nearly round, pale gray, covered with small knobs; 1/16 inch diameter	black, round and flattened covered with knobs; 1/16 inch in diameter	rounded, 1/16 inch diameter, gray covered with small knobs
found	roadsides, railroad lines, field borders, waste places	waste places and fields	common impurity in clover seed; wastes places

*calyx = the outer whorl of the flower parts; usually greenish and covers the other flower parts in the bud.

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MINNESOTA

CROP NEWS

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In this Issue

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Red Sorrel Rare but What a Sight

The weed red sorrel, also known as sheep sorrel or field sorrel, is a perennial in the same family as curly dock and pale dock as well as the smartweeds. Red sorrel reproduces by either seed or rhizomes and can obtain a height of over two and a half feet. The rather narrow leaves on this sorrel as compared to docks are very noticeable with the stem leaves sagittate (shaped like an arrowhead) with a long terminal lobe and two smaller basal lobes. Early growth is a rosette of basal leaves. The surfaces of the leaves are without hair. The flowers, within a panicle of verticillate (upright) racemes, are very noticeable. The flowers can be yellow to orange (male) and orange to red (female) and do occur on separate plants. More commonly occurring in areas of low fertility with poor drainage, the plants also like more acid soils so are less frequent west of the Red River. Maximum germination of the seed occurs from 68-86 F with light helping but not required for seed germination. New seed does seems to have a slight dormancy that may limit germination within the same year as production. The plant may flower from April until August. The seed are very small, three-sided, reddish-brown and shiny. The creeping rootstocks allow several stems to arise from a single crown. The seed and leaves of this weed are eaten by big game to ground-feeding birds although the plant contains low to moderate levels of oxalates. The plants have historically been used to produce a light grayish-pink dye although these plants can also cause hay fever. Controlled by several broadleaf herbicides, this weed is not a strong competitor as compared to many other perennials.

Potential Kernel Size Dictated by Conditions Now

With corn progressing into tasseling and silking, the plant is now in the phase to determine potential kernel size. Out in the field, silks should be visible outside ear husks and pollen shed should have begun on timely plants. Ironically, ear silks on corn begin to elongate from the base of the ear to the tip, thus if stresses are encountered toward the end of the pollination period the result may be nubbins (ears with barren tips). Below ground, the corn plant should have a healthy root system in order to provide adequate moisture and nutrient uptake at this critical time. Hot and dry weather will result in poor pollination and seed set (silks dehydrate, pollen shed is hastened, plants may miss nick, and leaf rolling by mid-morning due to extreme drought can decrease yield by 7% per day). A 100% yield loss can occur if hail completely defoliates corn at this time. Flooding, however, will not affect yield unless it is extended beyond 48 hours. Limits on moisture stress as well as rootworm beetle control (if five or more beetles per silk mass are seen) is important for corn now. Also, watch fields for European corn borer. Numbers thus far have been low, but observations over the next two weeks should determine if control will be needed this year. Scout fields to confirm good growing conditions for kernel fill.

Flower Power in Soybeans Herald Health

If your soybeans are progressing well into the R2 or full bloom stage, your crop is sending you a healthy message. On the other hand, if flowers appear fed on or eaten off--check your fields! The corn earworm as well as the bean leaf beetle both have an appetite for soybean flowers. The corn earworm usually doesn't occur in large, economic numbers on soybean plants as they prefer corn at this time. However the bean leaf beetle can appear. It usually emerges later (in August) but can feed on flowers, leaves and later pods if emergence is early versus late. Usually low in incidence in the Valley, no control guidelines are set for the bean leaf beetle, however, if three to seven beetles are found per capture in the sweep net method, treatment may be recommended. Also, consider other reasons for flowers that have fallen off or are not present. Water-logged soils, drought damage to soybean plants, a boron deficiency or a zinc deficiency as well as disease can all contribute to flower loss. Keep in mind, too, that soybean plants naturally abort 60 to 75% of most of their flowers. Any stress that greatly increases this abortion will greatly influence yield. Half of most natural flower lost will occur before pods develop and the other half will be lost due to pod abortion.

Baby Your Corn Now, Get Better Yields Later

Once corn has entered the tasseling stage (VT), any hail at this time will result in more damage than at any other growth stage. The loss of the tassel and the pollen source would result in no grain formation as would even the complete loss of the leaves. This period of pollen shed usually only lasts for one to two weeks depending on the hybrid and weather conditions. With silks visible, the R1 stage begins. Once a pollen grain contacts a new silk, fertilization can occur in only 24 hours. Silks grow one to one-and-a-half inch per day until fertilized. Usually only two to three days are required for all silks on a single ear to be pollinated. Once pollinated, the silk will turn brown then darken with age. Check your fields for pollination progress, knowing that totally brown silk masses are finished pollinating. With silking, the ear shank and husk growth are complete for the plant. Environmental stress can cause poor pollination and seed set. Any drought or moisture stress at this time will result in corn nubbins (ears with barren tips). Watch for corn rootworm feeding on silks and treat if numbers are economical (when an average of five or more beetles per silk mass are found during the first week of pollen shed or when silk clipping is occurring on 25-50% of the plants during pollen shed). With this stage, corn has finished all potassium uptake but nitrogen and phosphorus uptake is rapid. Nutrient availability to previously applied fertilizer is highly related to final grain yield.

Take the Tassel to Task to Determine Plant Health

As corn goes into tasseling, you can determine much about the plant health out in your fields. If the tassel after emergence is broken off, check the corn stalk for tunneling to determine if European corn borer is

present. If kernels begin developing in the tassel, you may simply have a genetic and environmental interaction that should not affect yield (this unusual symptom most commonly occurs on tillers). If one or more very small ears are formed on the plant (commonly on only tillers), this may be yet another symptom of a genetic by environment interaction. If the plant at tasseling shows a mass of leaves bunched together on the plant, especially at the top of the plant, you may be seeing crazy top, sorghum downy mildew or head smut. With head smut, the mass of leaves may eventually be replaced with a black, smutty mass that easily ruptures to release spores. Most of these diseases are usually low incidence and are thus not usually yield decreasing. However, if the tassel on your corn fails to emerge, different stresses may be affecting the plant. Water-logged soils, drought or heat stress could be causing the problem. Another possible stress, nutrient deficiency (especially boron) could be causing the lack of tassel emergence. And, insects, such as corn leaf aphids, could be slowing down tassel emergence. Twisting of the tassel may be a combination of any of the problems mentioned above or may be due to certain herbicide treatments, such as growth regulators, applied late. Continue weekly field scouting through tasseling to insure your corn crop is progressing optimally

Quick to Pollinate, Corn will be Quick to Blister

Right after pollination, corn will go into the R2 stage known as the blister stage. This stage in corn development usually occurs in only 10 to 14 days after the ears silk on each plant. The blister stage is identified by the kernel shape and color which is like a blister. Though difficult to see without a microscope, each "blister" already has the radicle, coleoptile and first embryonic leaf in each embryo. In other words, each developing kernel already has a miniature corn plant developing within the seed. At this stage, the cob of the ear is close to full size and the kernels are growing out from this material as starch accumulation is occurring. Kernels begin a very rapid seed-fill and this will continue until R6 or physiological maturity. The corn plant is still moving nitrogen and phosphorus around from vegetative parts (leaves and stem) to the reproductive parts (ear kernels) of the plant. At R2, the corn kernels are still 85% moisture. More kernel development is needed before viable seeds are available from the corn plant. At this stage, environmental conditions for the corn plant can also be determined. The browning silks at the tip of the ears can be used as a drought gauge! Hot and dry environmental conditions will cause the drying silks to turn an even darker color. Check your corn fields and check the color of the drying silks. Does the silk color change in various fields correspond to differences in rainfall received or soil types on your farm? Those fields with darker silks when finally dried down completely will be the fields under the most moisture stress (either water-logging or drought). Moisture stress dictates the probability of lower yields.

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MINNESOTA
CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 17 **www.extension.umn.edu** **July 14, 2000**

In This Issue

Nutrient Status of Minnesota Crops

George Rehm, Extension Soil Scientist

When assessing the status or progress of crops, early July is usually a good time to look back and project ahead. In general, crops across Minnesota appear to be in good shape. There are of course, the usual small pockets in some fields where excessive water caused damage. We can't ignore the extensive damage caused by unusually heavy June rains in the Red River Valley. Some notable concerns that appeared earlier this summer are described below:

Striping in Corn:
In mid-June, there were several questions about striping in corn leaves across southern Minnesota. Some questioned if this striping was an indication of sulfur deficiency. In general, this striping was a consequence of excellent growing conditions. Favored by ample rains and warm temperatures at night, corn was growing rapidly. With this rapid growth, corn leaves frequently show a striping on the half of the leaf closest to the whorl. This striping disappeared as the leaf was exposed to more sunlight and more chlorophyll was formed. This striping was **not** caused by a shortage of either nitrogen or sulfur.

Nitrogen Deficiency in Corn:
Each year, there are corn fields that show various severities of nitrogen deficiency. This year was no exception. For most fields with the light green color and yellow lower leaves, the deficiency was accompanied by excessive weed pressure. This is our usual reminder that weeds use nitrogen and compete with corn for this essential nutrient. Efficient management of nitrogen fertilizers cannot be accomplished without good weed control.

Zinc Deficiency in Corn:
Although not a frequent problem, the deficiency of this essential micro-nutrient was noted in some fields. The soil test for zinc is excellent and can be used to predict potential needs. Zinc deficiency is characterized by a wide, white stripe near the margin of the leaf. The alternate light green and dark green stripes are not indicative of zinc deficiency. Some varieties may show a bronze color near the margin if zinc is deficient. If in doubt about the use of zinc, use a soil test.

Iron Chlorosis in Soybeans:
Crop producers in the western half of Minnesota are all too familiar with this problem. The problem seems to be getting worse each year. This year, the cool nights in early June probably enhanced the severity. At the present time, there is no single management practice that can be used to eliminate the problem. There has, in the past, been a heavy emphasis on variety selection. This year, the varieties identified as being most tolerant also turned yellow. Some have turned from yellow to green in recent days. Others have not.

We are evaluating several management practices that might be useful in reducing the severity of iron chlorosis. At this time there are not any real promising ideas – stay tuned.

Harvesting and Storage of Field Peas

Hans Kandel, Red Lake County Extension Educator
Bill Wilcke, Extension Engineer.

Harvest management is especially important if field pea is to be marketed as human food or as seed. High-quality peas will receive a premium price when sold for human food or seed markets. If quality problems exist, including bleached, split, cracked, or earth-tagged (dirt attached to seed that cannot be removed) seed, the livestock feed market will likely be the only option.

Extreme care should be taken in harvesting the crop. Pea samples that have been harvested in a careless manner and contain excessive amounts of foreign material, cracked seed coats, and broken and damaged seeds will have heavy losses in the cleaning process. Field pea may be swathed before combining or straight (direct) combined. Field pea is normally swathed to preserve quality if there is uneven crop maturity or heavy weed pressure present.

When swathing peas, the seed needs to be at physiological maturity. At this stage of growth, the majority of pods should have turned from green to a yellow color. The crop matures from the bottom pods upward. Swathing will normally result in increased harvest losses, but swather modifications make the procedure easier and will reduce harvest loss. Peas should be swathed in the early morning or late afternoon when the pods are tough to reduce shattering losses.

The swather can also be used if cutting is delayed until the crop has reached full maturity. In this case the combine should follow immediately behind the swather; danger of swath damage by strong winds in a mature crop will thereby be avoided. The swather should be equipped with vine lifters (pick-up guards) and possibly a pick-up reel.
If green-cotyledon pea harvest is delayed, bleaching may occur. Bleaching is caused by rainfall at maturity, high humidity, bright sunshine, and warm temperatures. If green peas are swathed, timely harvest is essential, for green pea will be more susceptible to bleaching in the swath than if left standing.

When the pea crop is straight-combined, the following method is used. The vines are permitted to ripen; after reaching full maturity they can be successfully harvested, provided the combine is equipped with a floating cutter bar, a pick-up reel, and vine lifters are attached to the sickle guards.

Many short-to medium-vine and semi-leafless pea cultivars have characteristics that allow straight harvesting compared to cultivars with indeterminate and prostrate-vine growth. For example, semi-leafless peas have a more open canopy, remain erect longer, and dry down more rapidly after rain or heavy dew than indeterminate long-vine types.

The first choice for direct harvest of short-to medium-vine and semi-leafless pea varieties is a combine header with a floating cutter bar or flex head. Also, attachments such as lifter guards and pickup reels reduce losses and improve efficiency. Direct harvesting of weak-and prostrate-vine cultivars is most efficient with an aggressive pickup attachment and a lead coulter on a standard combine.

Since the pea seeds shell very easily when dry, they should be harvested during the humid part of the day, and action of the reels against the crop should be kept to a minimum. Very low cylinder speeds are required in conventional, transverse-cylinder combines to reduce seed splitting. Cylinder speeds of 350 to 600 rpm are normally used, depending on cylinder diameter and the moisture content of the peas. An initial concave setting of 0.6-inch clearance at the front and 0.2 inch at the rear is recommended. Adjust combine settings as crop and weather conditions change. Combine augers and grain loaders should be operated at full capacity and at low

speeds to reduce cracked, split, and broken seeds. Alternative seed handling equipment such as belt conveyors should be considered for handling seed intended for seed or the human food market. Minimize the number of times seed is handled. Also, don't handle peas during cold temperatures as potential for seed damage dramatically increases.

Peas containing green weed seeds or other foreign materials high in moisture content should be cleaned as soon as possible to prevent heating.

The pea crop can be combined at 16 to 20 percent moisture (wet basis) to keep splitting and shattering losses low and then air-dried for storage. Seed that is too dry will be susceptible to seed coat breakage or peeling.

Peas that will be sold for human consumption must be stored at less than 14 percent moisture, but storage moisture levels up to 16 percent are considered safe for the field pea. Peas at 18 percent moisture can be stored for 20 weeks at 68 degrees F. If drying is necessary, a maximum air temperature of 110 degrees F should be used for peas harvested for seed purposes and 160 degrees F for peas harvested for commercial use. Peas can be dried in storage with unheated air if an airflow of one to two cubic feet of air per bushel per minute is used. An aeration system should be present in the storage facility. Warm seed should be immediately cooled after binning, even if seed moisture is low.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Check Hybrids for Resistance to Corn Rust and Recent Growth Spurt

Corn rust is starting to show up in the Midwest. This corn disease shows up as rusty circular to elongate disease areas that are brown to cinnamon brown from the pustules scattered over the leaf surface that then become brownish black as the disease matures. Severe infection from common rust can cause chlorosis and death in the leaves and leaf sheaths of corn. Disease infection occurs in mid-June to mid-July under moderate temperatures (61F to 77F) and high relative humidity (greater than 95%). About six hours of moisture is required for the disease to germinate and infect. Common rust is most effectively controlled by growing resistant hybrids. General resistance results in reduced severity of disease infection. Fungicidal control is possible but usually not economic unless the application is made while there is limited secondary inoculum from the disease and if the area effected includes most of the field. So far, no cases have been confirmed in the North Dakota or Minnesota Red River Valley with reports limited to Illinois, Indiana, Iowa and Missouri where recent rainfall was heavy. Check hybrids now to confirm the hybrid you are growing is not showing any disease problems. Also, check fields to confirm recent growth with the sunshine on Sunday. Over the weekend, continuing growing degree days and sunshine has helped corn to leap-frog in height. Quick growth may confirm brittle stalks so if any field operations such as additional fertilizer application are made, realize the corn can be easily broken if care is not taken when moving through corn fields.

Is Rhizoc Roosting in your Soybeans?

Rhizoctonia diseases can show up in crops as damping-off, root or stem decay or even leaf or bud blight. Early postemergence soybean damping-off can reduce stands as much as 50% and later yield losses can be up to 40%. The causal fungus, Rhizoctonia, survives easily in the soil (up to three months in dry culture, 9 months in liquid culture) and it also has excellent saprophyicability on a very wide range of host plants which include most field crops, vegetables, ornamentals and fruits. Growth of this disease depends on nutrient supply, soil moisture, temperature and pH as well as competition from other soil microorganisms. A few cases of some rhizoctonia have been seen recently on soybeans as plants show lesions at the base of the stem, just below the soil line. The lesions are brown, dark brown or reddish with this initial infection possibly developing into a reddish brown cortical decay above the soil level on the plant. Carefully observe the plants and the root system to determine the problem as the stem lesions can easily be confused with hail damage or with dinitroaniline herbicide damage to the roots (due to the poorer root proliferation). Nodulation on the plant may be reduced and yields can be lessened. Preventative controls currently are the best solution. Use of fungicide seed protectants (although foliar systemic appear promising during better crop pricing), maintenance of good soil drainage and the use of less susceptible cultivars is encouraged.

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In this Issue

Plant Disease Clinic

Sandra Gould, Plant Disease Clinic

Corn-eyespot & anthracnose leaf spot, cultured for storage mold.
wheat-cultured for storage mold
soybean-Phytophthora sp root rot
barley-Barley yellow dwarf virus
oak-oak wilt
elm-Dutch elm disease
crabapple-fire blight
lilac-Phytophthora sp root & stem decay, bacterial blight
pepper-Impatiens necrotic spot virus (INSV)
radish-Aphanomyces sp root rot
astilbe-Rhizoctonia sp root rot
monarda-Pythium sp root rot
impatiens-Rhizoctonia sp root rot
bleeding heart-Tobacco rattle virus
hosta-Hosta virus X

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MINNESOTA
CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

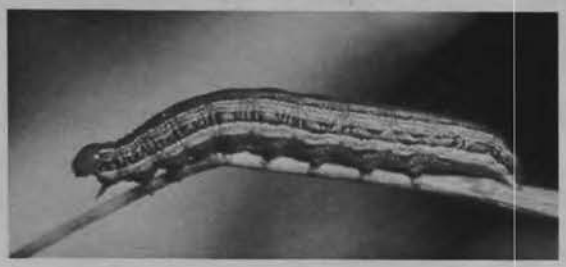
Volume 6, No. 15 **www.extension.umn.edu** **June 30, 2000**

In this Issue

Armyworms in Small Grains in the Red River Valley?

Ian MacRae, Extension Entomologist
Dept. of Entomology, NW Research & Outreach Center

There have been several reports of armyworms in the Red River Valley. Populations appear to be limited and confined at the moment but considering the heavy populations seen this year in the southern part of the state, it's wise to start scouting for these insects now. Armyworms do not overwinter here in northern Minnesota, our populations arise from adults blown in on southerly storm fronts in late spring and early summer. The earlier the growing season, the earlier it is necessary to scout armyworms. These insects are dark green to light brown and have a light stripe down the center of their back. Adults lay eggs in grassy or weedy areas or in lodged grain. Armyworms, like some cutworms, tend to feed at night and hide throughout the day. If feeding damage is found in the foliage and no other responsible insects pest can be found, scout for armyworms by parting foliage on the plant and inspecting the plant and the soil below for small fecal pellets. If pellets are found (or if no other causative agent for plant damage can be found) then look for larvae under plant trash, soil clods, or in soil cracks. If 4-5 worms or more are found per sq. foot, treatment is recommended.



Treatment options in wheat are:

Compound	Rate
Ethyl parathion 8EC	8 fl. oz/ac
Lannate	12-24 fl. oz/ac
Lorsban 4E-SG	1 pt/ac
Methyl parathion 8EC	8 fl. oz/ac
Penncap-M	2-3 pts/ac
Warrior	2.56-3.84 fl. oz/ac

June 21, 2000 -- Label Issued For Ronilan On Canola

Roger K. Jones, Extension Plant Pathologist

The EPA has granted a supplemental label for the use of the BASF fungicide, Ronilan EG (vinclozolin) on canola for the control of white mold. Ronilan EG may be applied up to one time per growing season. Application is recommended at 20%-50% flower (product label states this will normally be about 4-8 days after the beginning of flowering). 10.6 ounces to 16 ounces of Ronilan EG per acre may be used. Thorough spray coverage is essential; therefore, use adequate spray volumes and proper spray equipment. Please refer to the label for regulations for use and consult your local distributor for further information.

High-Salt Soils

George Rehm, Extension Soil Scientist

The white appearance on the surface of some Minnesota soils at this time of year is a reminder of a problem that has a serious negative effect on crop yields. The white crust is caused by a buildup of salts. Fortunately, this is a problem for a small number of acres. The soil condition, however, is serious for those who farm these soils. Is there a way to correct the problem? What management practices can I use to overcome the problem? Is the problem worse for some crops? These are common questions for those who farm these soils.

When the high-salt soils cause a problem with crop production, there is little that can be done to correct the situation. The key to any corrective action is to get water moving through the soil profile. Good internal drainage is needed before this can happen. Unless tile drainage is an option, there is little that can be done to remove excess salts from soils.

Those who have farmed these soils for a number of years know that crop selection is extremely important. Barley, wheat, and sugar beets are the most tolerant to the high-salt soils. Corn, especially soybeans and edible beans, do not grow well in these soils. Alfalfa will grow, but will not grow well. Growers who live with these soils also know that some varieties are more tolerant than others. However, there is not, as yet, a system that rates varieties for tolerance to high-salt soils.

Avoid double stress for crops growing on these soils. Root development is restricted in these soils and this causes stress early in the growing season. Therefore, avoid using a herbicide that may add stress to the crop. The herbicides that may restrict root growth when incorporated are not recommended. In addition, post emergence herbicides that may affect crop growth, even for a short period of time, are not suggested for crops growing on the high-salt soils.

There are no easy answers to the problem. Progress in improving these soils is slow. New management practices will be developed, but there are no immediate cures on the horizon.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Ping, Pain, Rain Go Away-Soybeans Chugging Away

Recent conditions in soybean fields have, in some cases, resulted in very yellow fields. Many different causes or a single stress may be contributing to the change of hue in your plants. Start by checking the variety planted and the soil pH. Iron chlorosis is showing up in many of the fields, especially those planted to varieties with poor iron chlorosis ratings and on soils above a pH of 7.5. Yield can be lessened as much as one bushel per acre for every one percent change in pH above 7.5 on susceptible varieties. And, the iron chlorosis in the Valley can be accentuated with soil wetness that increases bicarbonate solubility in soils and may elevate soluble salt levels, further stressing the soybeans. Any herbicide application made right around the first trifoliate leaf stage on stressed soybeans may also contribute to the yellowing if the plants were already laboring with iron chlorosis, varying temperatures, wet feet, insects, weed competition, disease, soil compaction or other previous damage such as hail or minor root pruning due to early, cool soils or overlapped preemerge/preplant/post herbicide applications. Generally, yellowing quickly disappears from soybeans; however, this year the problem seems to linger in areas hit hard with the flood rains. If each soybean plant is to survive the brutal flooding, apical growth on the plant should now begin to green and continue with healthy growth if the plant will have good recovery. And, green color all over the plant should return within two to three weeks unless continued stresses further slow plant development.

Knee-High by the Fourth of July

Scout corn fields, especially in water-logged fields, to determine if the corn stand survived the rains. Also, check on plant health to confirm that the corn is recovering from the beating nature took on crops in the Red River Valley. Also, jot down notes on how well your seed selection made it through this extreme weather to see how well your hybrid choice weathered the storm. Corn plants should be about knee-high or taller by the fourth of July unless continuing problems in fields limit corn growth and development. If the corn was planted in a timely manner but is slow to grow, check for symptoms both above ground and underground to determine what is causing problems. Warm, sunshine with less rain in many areas will promote corn growth. However, with warmer weather, keep scouting for pests that may take advantage of an easy harbour on stressed plants. Weed control, especially, will be important as fields slowly regain crop health.

Do You Hear Your Corn Growing out of the Wet Conditions?

The old wives' tale about corn growing so fast you can hear it is not far from the truth. During rapid growth of corn, especially under excellent growth conditions under good weather, corn does grow rapidly. Corn can produce a new leaf every three days during optimal growth. With a complete new leaf in that short amount of time, you can "hear" the corn growing! In fact, the rapid cell elongation and structure addition on the leaves are not really the rapid growth you hear, but the emergence of the leaves from the stalk top internode at multiple points over the field over time does create sound! Especially from the ninth-leaf stage to tasseling, corn is in a state of rapid nutrient and dry matter accumulation (although this accumulation continues through many of the reproductive stages). The demand for nutrients and water is also very high at this time. If your corn field is under optimal growth conditions during these stages, you should be able to confirm it by checking the plants every three days or so to see if another new leaf has been added onto selected plants. Once fields have dried to a reasonable soil moisture content and corn is back into good health, rapid growth should begin. Check your fields to see how your crop is progressing and if your crop is crackling with growth!

Small Grains Update

Jochum Wiersma, Small Grains Specialist

As Dr. Roger Jones wrote in last week's issue of the Minnesota Crop New, the recent wet weather favored disease development in wheat and barley. While scouting fields this past week, incidence if Septoria and tanspot is high and it can be found easily in most fields. However, the

severity of the leaf diseases is quite low and restricted to the lowest leaves in most cases. The cool damp conditions have also favored the development of powdery mildew. Incidence and severities are not as high as for tanspot but this disease can develop explosively if conditions stay cool and damp and a fungicide may be warranted. Leaf rust incidence and severity are low across the region, with many fields only showing single pustules on scattered plants. However, leaf rust remains an explosive disease as evidenced by the reports that in 7 to 10 days, spring wheat fields in southeastern North Dakota went from 0% to 100% incidence. Especially varieties with ratings less than MR and varieties known to be susceptible to the T-races should be closely monitored. Fusarium Head Blight or scab has not been confirmed as of yet and uncertainty remains. The spore sampling efforts by NDSU's Dr. Len Francl and show low spore counts, as does the PCR sampling technique developed by Novartis.

The decision to apply a fungicide is still warranted even if the spore counts for Fusarium head blight stay low. The economics to control the leaf diseases are actually better understood and the decision guides developed by Roger Jones and Marcia Mc Mullen explain in detail what factors will determine an economic return.

Small Grains Update

Ian MacRae, Extension Entomologist

Aphid pressure continues to be low in small grains throughout NW Minnesota despite receiving several southerly wind events so far this summer. The abundant precipitation is undoubtedly contributing to the suppression of aphid numbers both by knocking insects off plants and by facilitating the development of fungal diseases that infect aphids. In addition, natural enemies are especially prevalent this year, with healthy populations of both predators and parasitoids being found in small grain fields almost everywhere in NW MN. Barley Yellow Dwarf Virus also has a very limited presence so far this year.

Other insects which may yet play a role in small grains includes Orange Wheat Blossom Midge (OWBM) and armyworms. Emergence of adult OWBM is set to start throughout the southern part of the Red River Valley probably in the next several days. Peak emergence in the northern end of the Valley generally follows by 2-3 days. As we expect hotter weather to be moving in, this would be a good time to start scouting for OWBM. Remember, scouting is only effective just before dusk when wind speeds are below 6 mph and temperatures are above 59 degrees Fahrenheit as those are the conditions necessary for egg laying activity. Treatment thresholds are 1 adult midge per 5 heads. Insecticides labeled for control of OWBM in small grains are Lorsban 4E-SG and Penncap-M (which just received a full registration for OWBM this year). Armyworms have been found in several fields in NW Minnesota, so far only 1st instar larvae have been found. This is not necessarily a cause for worry, but considering this insect has risen to problem populations in the southern part of the state earlier this summer, the situation is worth keeping an eye on. Scout for armyworms by parting foliage on the plant and inspecting the plant and the soil below for small fecal pellets. If pellets are found (or if no other causative agent for plant damage can be found) then look for larvae under plant trash, soil clods, or in soil cracks.

For more information, check out the Red River IPM page at:

http://www.nwes.umn.edu/ent/redent.html

Soybean Root and Seedling Rots

Jim Kurle, Department of Plant Pathology

Heavy rains and prolonged periods of cool temperatures in May and June have created favorable conditions for the development of root rots, seedling rots, and damping off of soybeans. The combination of saturated soils and warmer soil temperatures occurring in June will create favorable

conditions for further development of Phytophthora. Although it is too late take action against these diseases in the current growing season, it is a good time to identify the fungus causing the root or seedling rot. This information can be used to aid in selection of varieties or management practices to limit these diseases in subsequent years.

Symptoms of diseases in the root rot complex are confusing. The first indication of their presence is poor stand. All four fungi cause seed rots and can cause pre or post emergence damping off. Pythium is most frequently associated with rotted, water soaked, "damped off" seedlings. The symptoms of Rhizoctonia are reddish brown lesions at the soil line on the stem. Fusarium root rot symptoms include brown to dark brown lesions on the root and on the stem below the soil surface. When Fusarium root rot is more severe the taproot may be completely destroyed and fibrous "adventitious" roots will develop above the rotted sections. If the stem is cut at or just above the soil line the vascular tissue may be brown or discolored.

Phytopthora can infect the soybean plant at any stage in its life cycle. Before emergence, the fungus can cause seed or seedling rots. Shortly after emergence infection can result in damping off or may be accompanied by the development of reddish-brown sunken lesions. As the seedling develops, Phytophthora infection causes chlorosis and leaf yellowing. Infected plants may continue to die throughout the growing season. Plants that have died from Phytophthora infection retain their leaves and possess a characteristic "shepherd's crook" at the tip of the main stem. Formation of a reddish brown stem lesion that begins at the soil line and progresses up the stem is a diagnostic characteristic of Phytophthora infection in the stem rot phase.

Use of resistant varieties and seed treatments are the best methods of reducing losses to fungi of the root-rot complex. Resistant varieties are available for Phytophthora, but the resistance genes are effective against one or a few races of P. sojae (Table 1). Their usefulness against this disease can be lessened in Minnesota by the presence of a number of different P. sojae races. In our work and through the efforts of the Plant Disease Clinic we have determined that at least eight Phytophthora races, races 1,2,3,6,7, 21, and 25, can be found in Minnesota soils. This survey is incomplete but it indicates that races are present in Minnesota that can overcome Phytophthora resistance sources in most soybean varieties planted in the state.

Table 1. Reaction of resistance genes found in public or private soybean varieties available and adapted for planting in Minnesota.

	Resistance Gene		
Race	Rps1a[†]	Rps1c	Rps1k
1	R	R	R
2	R	R	R
3	S	R	R
4	S	S	R
6	S	R	R
7	S	R	R
21	S	R	S
25	S	S	S

[†] R=Resistant, S=Susceptible

Prolonged use of a variety with resistance to a specific Phytophthora race will select for races that can overcome that source of resistance. Poor performance of a resistant variety is an indication that this has happened. The best option available to a farmer is to plant a variety that utilizes a different resistance gene. No varieties are available in Minnesota that are resistant to the pathogens causing Fusarium, Pythium, or Rhizoctonia root-rots. If these pathogens are identified as the cause of root or seedling roots, seed treatment is the most effective method of disease management.

Seed treatments can protect against root-rots caused by all four pathogens for a limited amount of time after planting. They are most effective when used where disease pressure from root or seedling rots are most likely to be severe. This occurs when soybeans are planted into cold soils, in early plantings, in no-till or reduced tillage situations, or when planting is followed by several days of rain. Combination fungicide treatments such as Apron/Maxim(or Rival/Allegiance(offer protection against all four root-rot pathogens.

Because symptoms caused by the root rot fungi are so similar, particularly when seed rot occurs, the most accurate method of identification is by isolation and culturing from plant tissue. In addition, Phytophthora race typing is available on a limited basis when isolates are obtained from

soybean fields where it appears that Phytophthora resistance provided by the Rps1c or Rps1k gene has broken down. There is a $20 fee for each procedure.

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Samples should be sent to:

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MINNESOTA
CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In this Issue

Soil Sampling For Diagnosing Crop Problems

George Rehm, Extension Soil Scientist

Each year most of us are called on to diagnose problems with crop growth in a variety of fields. Occasionally, diagnosis is easy. However, providing an explanation for the cause of most problems requires some detective work. Collection and analysis of soil samples from these fields can help with this detective work. However, the process used in collecting soil samples for detective work is different from the process used in routine sample collection. Some guidelines for this special sampling are described in the paragraphs that follow.

A single sample from the problem field will usually not provide an answer. To be thorough and complete, three samples are needed if nutrient deficiencies are suspected to be the cause of a problem. If nutrient deficiencies are responsible, the growth (or stunting) will not be uniform across the entire field. Crop growth will range from good to poor. For these situations, one soil sample should be collected from an area where the crop is exhibiting good growth. The second sample should be collected from an area where the stunting or abnormal growth is most severe. The third sample should be taken from an area where the symptoms

are just starting to appear. This marginal stunting or poor growth usually can be found in areas adjacent to the portion of the field where the most severe stunting occurs.

An evaluation of the combined results of the analysis of each sample can frequently identify the cause of a problem – if the cause is associated with a nutrient deficiency. This sampling procedure will not identify the cause if poor growth is associated with incorrect application of herbicide, diseases, or plant pests.

Sampling depth should be the same as the depth used for sample collection used for the purpose of making fertilizer recommendations. If problems with immobile nutrients are suspected, this is 0 to 6 or 0 to 8 inches. If a problem with a mobile nutrient (nitrogen) is suspected, collection of deep samples may be necessary. One suggested approach would be to collect soil from depths of 0 to 6, 6 to 12, 12 to 24, and 24 to 36 inches. Several cores are required from each of the three areas.

There is no guarantee that this sample collection strategy will provide the answer to a problem. However, this process will provide much more information compared to the analysis of a single sample which is supposed to represent the entire field.

Barley Yellow Dwarf

Dave Schwartz, Extension Educator-Meeker County

Two barley fields in northern McLeod County and southern Meeker were found to be severely infected with Barley Yellow Dwarf (BYD). Aphids are the main vector transferring the virus from plant to plant as they feed. Individual plants within a field that have been infected are stunted, depending on the time of infection. Plants are yellow with striping of leaves. BYD infects barley, wheat, and oats. Control measures for BYD are to plant varieties with resistance and plant early in spring. Due to the mild winters, aphids seem to have over-wintered better so the disease is more prevalent across northern states this year.

2000 Ag Professional Field School

Kevin Cavanaugh, IPM & Ag Professional Program Coordinator

The 2000 Ag Professional Field School will offer two Sessions, which will be held at the Southern Research and Outreach Center-Waseca. Session I will run July 11-12 and Session II will run July 13-14. Both Sessions will be identical in content.

This is a hands-on, in-field program emphasizing corn, soybean and alfalfa management skills. Participants will have the opportunity to enhance their troubleshooting and crop management skills in specially designed plots that display actual cropping situations. The Field School is targeted towards sales people in seeds, chemicals, fertilizer, crop consultants, crop production specialists, agronomists, and county extension educators. A total of 12 CEU have been requested for this program. Each Session will offer the following: Soil and Water Management, 2.5 hr; Pest Management, 7.0 hr; Crop Production, 2.5 hr.

Participants will be placed in small groups based on their professional experience. The registration fee is $275.00 and registrations must be received by June 30, 2000. The Field School brochure includes the registration information and will be mailed out next week. To receive a program brochure and registration information, contact Tracey Benson at (612) 624-3708 or 800-367-5363. If you have questions regarding program content, contact Mike Schmitt at (612) 625-7017 or Kevin Cavanaugh at (612) 625-2778.

General session topics and instructors will include:

Session I & II, July 11-14

Soils Properties and Crop Production, John Lamb, Neal Eash, Gyles Randall, Lowell Busman, Jeff Strock, Carrie Laboski-University of Minnesota; Bob Schoper, Agriliance

Weed Identification, Beverly Durgan, University of Minnesota

Field Crop Diagnostics, Kevin Cavanaugh, Dale Hicks, Paul Porter, Dan Martens, Seth Naeve, Lisa Behnken, Mike Schmitt

Weed Management, Jeff Gunsolus, Tom Hoverstad-University of Minnesota; Eric Spandl-Agriliance

Entomology, Ken Ostlie, Bill Hutchison, Eric Burkness,, Fritz Breitenbach, Bruce Potter-University of Minnesota

Wet Weather and Fungicide Spray-Decisions in Wheat

Roger K. Jones, Extension Plant Pathologist

Much of the Red River Valley has experienced consecutive days of wet weather that has led to phone calls and questions regarding the use of fungicides in this years crop. As of this writing, many producers were faced with extremes: consecutive weeks of dry weather followed by excess rainfall and rain events. Dry conditions early retarded the development of Tan spot. Leaf rust levels have been low to very low although some inoculum is out there and fields of moderately susceptible varieties such as Forge, Gunner and Ingot should be watched carefully. To date, aphid population have also been reported as low to very low. This means that spray decisions should focus on Septoria diseases and Fusarium head blight.

Timing sprays for control of Septoria and suppression of FHB should focus on heading. It is still early enough that perithecia of the scab fungus could develop in infected residues present in wheat and barley fields. The recent rains will facilitate their development, particularly if temperatures remain cool and rains persist. Of equal concern, and maybe even greater concern, is the potential for Septoria diseases to develop in wheat. The development of Septoria will be favored by recent rains and past experience suggest that even fields that have been rotated to other crops can develop damaging levels of Septoria if rains continue.

Wheat stands, in general, are good and yield expectations remain high. In many areas, rains have removed drought limiting concerns. Price and LDP program options are favorable for optimizing yields and this should include controlling diseases. Septoria can be effectively controlled with 4 oz. applications of Folicur or Tilt fungicides. Spray timing should be at Feekes 10.5 (wheat fully headed). If FHB were an additional concern, applications should be timed to coincide with 15 - 25% anthers visible. In the case of FHB, Folicur may be a better choice than Tilt. If leaf rust or powdery mildew are present, Tilt may perform better than Folicur. My experience has been that both of these materials will effectively control Septoria diseases. The action of these materials is to suppress the incidence of FHB and to restrict the enlargement of leaf lesions caused by Septoria.

Research trials conducted in 1997 suggested that spraying at Feekes 10.5 was as effective or more effective in controlling Septoria than applications to Feekes 8.0 (flag leaf emergence). Best control of Septoria will occur when flag leaves are fully expanded. There is some "kickback" or post infection activity with either Folicur or Tilt. Ground application is preferred but aerial application will also be effective.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Water, Water Everywhere, Will the Waterhemp Appear?

An annual, common waterhemp loves moisture. Found in marshes, sandbars, river banks, roadsides and even cultivated fields, the erect or ascending plant is a very aggressive weed. One reason this weed is difficult to control is that it can hybridize with several other species of pigweed making not only identification difficult but control complex. The plant has a taproot and flowers between June and October. Germination of the very small (about 1 mm in diameter), smooth, shiny black to reddish brown seed seems to be augmented with light during a 16-hour photoperiod, shallow depth of planting and soil temperatures of 75-84 F for the optimum conditions. Seeds may have variable dormancy that allows seeds to set without germination the first year the seed drops. Seed stored at lower temperatures, such as at 41F, and planted the following year showed excellent germination. Not difficult to control early, either common waterhemp or pigweed can be stopped if caught before the weeds have acclimated or adapted to environmental stresses (especially weeds below four inches tall). In corn, look at the following herbicide possibilities and examine which one would work in your field based on current weed size and size of the corn crop: Accent, Accent Gold, Atrazine + oil, Basis, Basis Gold, Celebrity Plus, Distinct, Liberty products (on Liberty-linked corn), Lightning (on Clearfield corn only where ALS resistance is not a problem), or NorthStar (where rotation is not a concern). In soybeans, consider the best fit from among: Blazer, Cobra, Extreme (on Roundup-ready soybeans), Flexstar, Harmony GT, Liberty products (on Liberty-linked soybeans), Pinnacle, Pursuit (only where ALS resistance is not a problem), or Raptor (only where ALS resistance is not a problem).

Herbicide Injury in Corn Low Here

Recent reports from Illinois have shown corn injury from the herbicide Aim. This new postemergence corn herbicide was first registered in the United States in 1999. Low cost and effectiveness on such weeds as velvetleaf has allowed this PPO (portoporphyrinogen oxidase inhibitor, like other herbicides with this mode of activity (Authority, Blazer, Flexstar, Cobra), to be used. If injury is seen, it will usually occur within hours following the application and will show tissue chlorosis and necrosis on the corn plant. This "burn" look on the crop is due to rupturing of plant cell membranes.

Five years of research on this chemical through several states has shown that this herbicide can show corn injury ranging from 0-30% following postemerge applications. The symptoms usually seen are the necrotic lesions and in more severe cases breakage of leaf midribs on some of the leaves. Symptoms usually do not persist over 30 days after application.

This year in Illinois, the symptoms not only showed the classic leaf "burning" symptoms but also showed a tight wrapping of the uppermost leaves. This "buggy whipping" will usually be outgrown by the plant, but not on all the plants this year in Illinois. This year the more severe damage may be due to one of several speculated causes including: applications to wet corn foliage (dew or precipitation shortly after application) may have concentrated the chemical in the corn whorl; the plant may not have been able to metabolize the herbicide quickly enough; application with a crop oil concentrate (COC) not under dry conditions generally needing the use of the COC; or, tank-mixing Aim with another emulcifiable concentration (EC) herbicide with the total mix applied during environmental extremes. See the complete article from Illinois and pictures of damaged plants at: http://spectre.ag.uiuc.edu/cespubs/pest/articles/200011j.html.

Soybean Fields Should be Scouted

Check your soybean fields for overall crop stand and health--now is the time to check for seedling mortality (from Pythium, Phytophthora and Rhizoctonia) and root and lower stem decay (from Rhizoctonia, Fusarium and Phytophthora). Soybean health is compromised by plant diseases that infect the soybeans at different growth stages. Some infections can occur early, but do not cause apparent symptoms until later growth stages. Often with soybeans, seedling health is ignored because plant populations are acceptable and this "rotation" crop is rarely on a farmer's prime crop list despite good pricing in past years. Plant health is very important to assess during the VE to V4 stages of soybean growth. Information gained in scouting fields can explain symptoms later in the season or less than anticipated yields as well as be used to make adjustments in crop management in subsequent years.

V6 Stage Important in Corn Development

The V6 stage of corn usually occurs around 475 growing degree day units or 24 to 30 days after emergence. All of the plant parts that "manufacture" yield are present at this stage. Both the growing point and tassel, which were differentiated in V5, are now above the soil surface. The corn stalk is beginning rapid elongation. Determination of kernel rows per ear is being established and is strongly influenced by hybrid genetics. Tillers (suckers) begin to emerge on the plant and degradation and loss of the lower leaves on the plant begins. Under good conditions, a new leaf should emerge every three days. The nodal roots are established on the plant and are now the main, functional root system. Troubleshoot for lodged plants (rootworm eggs will soon hatch and larvae will feed on the roots); foliar defoliation from hail, wind and leaf feeding corn borers (stress can decrease kernel row number); water-logged soils can slow down plant growth and development; yield loss can be up to 53% if hail completely defoliates the plant; and, severe yield loss can occur with flooding. Remember to scout and time supplemental nitrogen application before rapid uptake in corn (up to V8 stage). Precise fertilizer placement is less critical at this corn stage.

Scouting on Soybeans, Determine Defoliation

After trifoliolate leaves form on soybean plants, determine damage from insects or diseases or environmental (water) causes by estimating defoliation and main stem damage. Leaves injured by hail or wind may be torn and ragged. Stems may be cut off, broken or severely bruised. Diseases may develop in damaged leaf and stem wounds or insects may take advantage of damaged plants. Soybeans usually recover from hail and wind damage if plants are not cut off below the cotelydonary node. The extent of yield loss, however, will also depend on the severity of the damage and the growth stage of the soybeans. Typically, soybean plants in the vegetative growth stages recover much better than plants that have entered later, reproductive stages. Scouting at least once a week if not more frequent after defoliation or water damage has been seen is essential. Determine the cause of the defoliation and if the damage is caused by a controllable pest, determine the economic threshold for control measures. If the damage is due to environmental defoliation, check more often across the fields to insure that no further damage, such as pests attacking weakened plants, occurs.

Point Soybeans to High Yields

Soybean yield is dependent upon the rate and length of time for dry weight accumulation. The rate of dry weight increase is very slow in soybeans at first but gradually increases through the V-stages (vegetative stages) as more leaves develop and ground cover increases. During the reproductive stages (R-stages) and after pollination, the beans begin rapid dry weight accumulation, first in the larger pods (bottom of the plant, up). By R5.5 all the beans have rapid dry weight accumulation. This accumulation then slows around R6.5 and measurably stops by the R7 stage (finishes from the top of the plant, down). Help point soybeans toward high yields now by monitoring and controlling pests as needed and keeping stands healthy through to physiological maturity. Check now for root health and overall plant condition, especially in water-logged fields or those that are a heavy clay soil type. Weekly rains have provided plenty of moisture in most locations to fill the soil

profile. Fields with good drainage will allow the soybean plants to take advantage of the ample moisture but not have to fight water-logged stress conditions. Once the soybean gains five trifoliate leaves, the plant is about one week from first flower. Going into flowering with ample but not water-logged conditions will insure excellent pod set.

Effects of Wind and Hail on Corn and Soybeans

Recent high winds, some with small hail, may have affected crops. Corn at the fifth-leaf stage has the growth point at or slightly below the soil surface. Corn at this stage or earlier should recover from any wind or hail damage. At the sixth-leaf stage, the growing point on corn is above the soil surface and the plant has initiated rapid stem elongation. Fields at growth stages beyond this sixth-leaf stage should be carefully scouted and monitored to insure that corn will recover. Lodging of corn plants may only be a temporary condition, unless high winds or hail snapped off the main stem completely. With complete loss of the main stem and if no tillers are present and viable, consider the corn growth stage to determine if the growing point was protected and regrowth can occur. With good growing conditions, three to five days should show if the corn will recover. With soybeans, plants cut off below the cotyledons will not recover. While some damaged plants may have trouble recovering, regrowth can occur on soybeans from either one of the axillary buds located at the point where the cotyledons are attached to the main stem or from any of the branch axils. Bruising of either crop may also have occurred. Bruised stems weaken the plants and may cause them to break at a later time. However, yield is not affected by bruising as long as plants do not break.

Discolored Corn Clues You to Causes

Corn plants that appear discolored during emergence to knee-high are sending you a signal. Look for the symptoms to interpret the cause: leaves weak and flaccid with a lighter green color– water-logging of soil combined with other conditions that might limit root extension and growth; rapid wilting of young plants similar to symptoms of drought, nutritional deficiency or insect injury later showing leaves that are pale green to yellow streaks with irregular wavy margins that parallel the leaf veins and may extend the length of the leaf, even later, lesions may develop and turn brown--Stewart's bacterial wilt (infection by the corn flea beetle); visible lesions and discoloration of the root system with above-ground yellowing and stunting—seedling blight or root rot (at least 14 species of fungi can cause problems) caused by high moisture levels and low temperatures accompanied by low oxygen levels in the soil; leaves sandblasted, pale green to whitish--wind damage or spider mites feeding under the leaves; lower leaf speckling, new growth undamaged--herbicide injury; general yellowing of upper leaves--magnesium deficiency; general yellowing of lower leaves--excessive moisture; yellowing in the whorl--herbicide injury; purpling or reddening of leaves--phosphorus deficiency, compacted soil, cold weather (especially on certain hybrids), white grubs, dinitroaniline herbicide injury; leaves bleached white--herbicide injury; irregular leaf mottling on base leaves--maize dwarf mosaic or chorotic dwarf virus; light gray or silvery blotches on both sides of leaves--sunscald or frost; light streaking of leaves--zinc deficiency; bright yellow to white stripes on scattered plants through the field--genetic stripes; white or yellow stripes between leaf veins--excessive soil acidity, magnesium deficiency or maize white line mosaic virus (if lines are not continuous); bleached bands across leaves--air pollution injury; and, yellow leaves and spindly plants--nitrogen deficiency or sulfur deficiency (if more pronounced on younger leaves).

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In this Issue

Continue to Check Regrowth Alfalfa for Leafhoppers, Plant Bugs, Weevils

Bill Hutchison, Extension Entomologist

Some fields may have enough potato leafhopper (PLH), plant bugs (Tarnished and/or Alfalfa Plant Bug), and/or weevil larvae to warrant insecticide treatment. However, most weevil larvae should now be pupapting (litter, soil layer). Threrefore, most of the current damage is from PLH or plant bugs. Both nymphs and adults of each complex can cause damage, which includes piercing-sucking feeding within the plant's phloem tissue. This feeding damage disrupts normal nutrient flow through the plant, resulting in stunting of the plants. The most characteristic sign of plant bug damage is a crumpling of the leaves. PLH feeding eventually results in yellowing of leaf tips, commonly known as hopperburn. Stunting by both pests initially results in dry matter yield loss, with subsequent losses occuring in protein content and/or RFV.

Economic Thresholds for PLH range from 0.5 to 2.0/sweep, for alfalfa that is 5" to 12" in height, respectively. Plant bug thresholds (both species, and nymphs + adults combined) range from 3-5/sweep (Univ. of Wisconsin). My suggestion is that these thresholds be used as a guide in making a decision for a specific field, i.e., if the pest density for one or both pests is "borderline", also consider any obvious feeding/stunting damage to the regrowth, the $Value of the hay for the next cutting, and anticipated cutting schedule for a given operation (e.g., 3-cut vs. 4-cut system). If the regrowth is showing considerable leaf/stunting symptoms (with the potential for a maturity/cutting delay), yet the density for each pest is just below threshold, insecticide treatment will likely be economical.

As indicated in a previous article, the following table provides a summary of currently labeled insecticides for alfalfa, including PHI, REI, etc.

Re: Insecticides labeled for Alfalfa, Y2K:

There have been several recent, important label changes you should be aware of for use in alfalfa.

1- Cygon 4E: NO LONGER LABELED FOR ALFALFA. This has been a popular choice for Potato Leafhopper control; it is relatively inexpensive, works well at low rates (0.5 pt/ac), has good residual control of PLH nymphs as they hatch. Alternative dimethoate formulations (i.e., identical Active Ingredient), however, are still labeled, including: Dimethoate 400 (Clean Crop; United Ag Products), Dimate, - (all hvae REI 48 hours)

** NOTE: some recent guides still refer to Cygon; however, this product was discontinued.

** Check with your local/regional dealer(s) for availability of these alternative Dimethoate products.

2- Penncap-M is NO LONGER LABELED FOR ALFALFA; one alternative material with the same Active Ingredient, "Declare" (Griffin Co.) is still labeled, but the Re-entry interval (REI) has been increased from 48 hours to 4 days. (see Table below).

3- Dylox: no longer labeled.

Current Rate, PHI, REI information for registered alfalfa insecticides, 2000.

Insecticide	Rate/ac	PHI (Days)	REI (Days, hrs)**	
Ambush 2E*	6.4-12.8 fl oz	0 for 6.4 oz or less;	14 otherwise	12 hrs
Pounce 3.2E*	4-8 oz	0 for 4 oz or less;	14 otherwise	12 hrs
Dimethoate 400	0.5- 1.0 pt	10 for harvest or pasturing	2 DAYS	
Baythroid 2*	1.6-2.8 oz	7		12 hrs
Furadan 4F*	0.5-2pt	7-28	2 DAYS	
Lorsban 4E	1-2 pt	14-21	2 DAYS	
Sevin XLR+	2-3 pt	7		12 hrs
Warrior T or 1E*	2.6-3.8 oz	1 (forage); 7 (hay)	1 DAY	
Declare (m-parath)*	0.5-2.0 pt	15	4 DAYS	

*Restricted Use Pesticide (RUP); check the label for other restrictions, including PHI for specific rates, Restricted Entry Interval (REI, e.g., 24 hrs).

Notes: To avoid/minimize bee kills, do not treat alfalfa during bloom. Also treat between 5pm-dusk, or very early in the morning, to use insecticides when bees are least likely to be exposed (early am applications are also recommended to minimize drift, via lower wind speeds). Treatment of fields that contain blossoming weeds or other plants, can also result in severe bee losses.

** The REIs provided above are correct, to our knowledge, at this time. As always, the registrant and the label are the final authorities on current REIs and all other use information. As you know, regulations are changing rapidly as a result of FQPA; uses may be deleted and use restrictions may be changed at any time.

For future reference, CDMS is an excellent source for current labels, from all major suppliers (bookmark this site):

http://www.cdms.net/manuf/manuf.asp

For more information on Alfalfa Insects, Sampling and Thresholds, see (or order) the following fact sheet:

http://www.extension.umn.edu/distribution/cropsystems/DC3516.html

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Mullein Multiplied during the Cool Weather

Common mullein, also called flannel leaf, feltwort or Jacobs staff, is a biennial that you might not notice the first year. The first year of growth, the weed produces only a rosette. The flowering stem does not come out on the weed until the second year in most locations. Seed reproduction is on a spike after the sulfur yellow flowers are pollinated. The taproot of the plant allows the plant to grow rapidly under the right conditions. Light exposure enhances seed germination but seed germinate over a wide range of light exposures with only a five second light induction to induce dark germination. Temperatures from 59-68F are optimum for weed germination as seen by the prevalence of this weed after the cool conditions at the end of May and into the first week of June. Historically, the leaves of this weed were used to make a tea that was used as a sedative and the dried flowers and roots were smoked to provide relief from asthma. Control this pesky weed from multiplying across fields, especially in coarser soils where it thrives, with many of the broadleaf herbicides available (especially the growth regulators or ALS enzyme inhibitors such as the triazolopyrimide herbicides where these can be used) or by eventual crop shading, however, make sure spray coverage is excellent and an oil or surfactant is used where possible to enhance herbicide intake on the weed's woolly leaves.

Ah-la-la, Lined up Like Little Tin Soldiers

Throughout the Red River Valley, soybeans should be emerged and easily rowed. Recent moisture and warm conditions have the cotyledons emerged and rapid growth progressing. Stages of soybeans throughout the Valley range from the cotyledon stage up into the third trifoliate. With optimum conditions, a new soybean stage can be expected every three to five days. Plant populations vary depending on seeding rate, field conditions and recovery from the very cold nights and cool days at the end of May and into the first week of June. If plant populations are still above 150,000 plants per acre, you still have the potential for 100% yield. 118,000 plants per acre are about 75% of the optimum and still have a 98% yield potential. 78,000 plants per acre are at 50% of optimum but can still produce 90% of yield if optimum conditions continue throughout the season. 39,000 plants per acre are at 25% of the optimum stand and yield drops to 75% or lower. Planting or replanting after June 9th, will drop potential yield on soybeans below 76% of the optimum in the Red River Valley. Planting or replanting after June 14th drops the yield potential to below 70% of optimum. Planting soybeans after June 15th is not advised. Determine your yield potentials for each field. Also use comparison formulas on poorer fields to assess replanting or late plantings by using yield loss estimates from the different scenarios:

Field not replanted: (potential yield gain$ minus total losse$ due to reduced stand)

Versus

Field replanted or late planted: (potential yield gain$ minus total loss cost$ due to late planting and to other seed/chemical/equipment cost$)

And consider crop insurance restrictions and benefits.

Flixweed Off to Fast Start but Temps Tone Down Trouble

Flixweed is an introduced annual or biennial that

resembles tansymustard. The seed produced by the weed are encased in siliques with several seeds in each cell, each silique with two cells. The root is a taproot that is easily controlled by cultivation but flourishes in no-tilled situations. Seed frequently show dormancy with more germination occurring after one year after seed set although some germination can occur with recently harvested seed. Alternation of light to darkness within a temperature range of 73F to 86F hastens germination of the weed seed. The difficulty with this weed is that once flowering initiates, such as is occurring on some of these weeds currently, it is very difficult to stop seed set. Treatment too late into beginning seed set will result in some seed being returned to the weed seed bank. Herbicides that work best to control flixweed in corn with POST applications include: Accent Gold (on 88-day or higher hybrids 20 inches tall or less), Atrazine and oil, Basagran, Basis Gold (on 88-day or higher hybrids up to 12 inches tall), Celebrity Plus (hybrids 4 to 24 inches tall), Curtail (corn up to 8 inches tall), Hornet (corn up to 24 inches tall), Liberty ATZ (on Liberty-Linked corn up to 12 inches tall), Lightning (on Clearfield corn), Northstar (where residual carryover is not a problem and corn is 4 to 20 inches tall), Permit (corn up to 36 inches tall), Sencor (on hybrids more than 8 inches tall), and Roundup (on hybrids up to 30 inches tall or any of the Roundup mixes such as ReadyMaster ATZ for Roundup-Ready corn up to 12 inches tall). Herbicides that work best to control flixweed in soybeans with POST applications include: Basagran, Liberty (on Liberty-linked soybeans up to full bloom), Pursuit (after the first trifoliate but before flowering), Raptor (after the first trifoliate but before flowering), Rezult (emergence to 30 days prior to harvest), and Roundup or Touchdown (and Roundup mixes from soybean emergence to full flowering).

Flip-Flop, Capsized Corn will Carry

Heavy winds over the weekend combined with the recent rapid growth of corn in areas flush with moisture may have you seeing sideways. Unlike that Tower of Pisa, corn has the ability to reorient in any soil type with continuing excellent growth conditions. Much of the corn in the Valley is at the third to the sixth leaf stage and can quickly reestablish into an upright orientation. After the fifth leaf stage, the growing point on corn is above ground and as this growing point progresses higher, the plant is more at risk to damage from lodging and brittle stalk breakage. Very rapid growth begins occurring in corn at the sixth leaf stage to tasseling. Consider wind conditions carefully and corn field orientation and exposure to winds as well as benefits from windbreaks protecting fields if growth regulator herbicides are being used at this time.

Know your Soils-Buse Soils

The Buse soils have thin, very dark gray to a grayish brown loam that is calcareous (high pH) in the top soil horizon. The lower soil horizons are light brownish gray to a light yellowish brown, again calcareous even to the point of occasionally having white to light gray soft masses of lime. The Buse soils have pebbles and stones showing up within 5 to 10 percent of the soil. The soils are well-drained and the topography is often rolling, hilly and possibly even showing stony slopes. Often fields with the Buse soils are used for hay or pasture. The undulating to steep slopes were caused by glacial moraines. Annual precipitation where the Buse Soils occur is around 16 to 24 inches as seen in eastern North Dakota, western Minnesota and northeastern South Dakota. The native vegetation on these soils before extensive use was little bluestem, needleleaf sedge, needleandthread and blue grama. Often in association with the Barnes soils used for cropland, these soils can present more of a challenge if cropped due to the limitations on water-holding capacity of the Buse soils.

Finish Side-Dressing Soon on Corn

Warm temperatures and timely rains in much of the Valley have boosted corn growth. Corn entering into the sixth to seventh leaf stage is rapidly absorbing nutrients and the growing point is now above ground. The rapid stem elongation beginning can be easily induced into a brittle stem state if growth regulator herbicides are applied and wind conditions such as those seen along I-94 in the Red River Valley this weekend prevail. Some

tillers at the V6 to V7 corn stages may initiate depending on plant genetics, density, fertility and environmental conditions. Nodal roots are active on the corn plant and even the third whorl of roots should be actively growing. Side-dress nitrogen on corn up to the eighth leaf stage but not beyond to prevent excess root pruning or injury to the above-ground plant. Roots at the V6 to V7 stages should be extending down into the soil about a foot and a half and the radius of the roots should extend to two feet across.

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In this Issue

Minnesota Farm Assistance Program

Kent Thiesse, University of Minnesota Extension Educator

The 2000 State Legislature passed a limited "Agricultural Assistance Program" that will be available to farm operators in some parts of the Minnesota, primarily in the Northern part of the State. Producers from throughout Minnesota that missed the deadline to apply for the "1999 Farm Assistance Program" also have one more chance to apply for that Program. The extended application deadline is until June 30, 2000.

Farm operators that were eligible for a Farm Assistance Payment in 1999, but did not apply by the deadline in 1999, now have until June 30th to make application. This application is based on the production year 1998. The extended filing deadline applies to both the $4.00 per acre payment option and the property tax refund option. Farm operators that already received a 1999 assistance payment are not eligible to make another application, even if their crop acreage changed from the initial application. Farmers must make application for a 1999 payment on "Form AG-1", and must submit that application to the Minnesota Department of Revenue. Persons needing and application form or with questions regarding a 1999 application should call the Department of Revenue (1-800-652-9094), as they are responsible for administration of the 1999 Farm Assistance Program.

The Minnesota Department of Agriculture will administer the "2000 Agricultural Assistance Program" and this year's Program is somewhat

different from the 1999 Program. The 2000 Program provides financial assistance to farm operators and owners in 31 Northern Minnesota Counties that were declared a "disaster area" in 1999, due to excessive rainfall and poor crop growing conditions.

Counties eligible for the 2000 Program are : Aitkin, Becker, Beltrami, Carlton, Cass, Clay, Clearwater, Cook, Crow Wing, Hubbard, Itasca, Kanabec, Kittson, Koochiching, Lake, Lake of the Woods, Mahnomen, Marshall, Mille Lacs, Morrison, Norman, Ottertail, Pennington, Pine, Polk, Red Lake, Roseau, St. Louis, Todd, Wadena, and Wilken. Farmers in other Minnesota counties are not eligible for the "2000 Agricultural Assistance Program".

The 2000 Assistance Program provides a $4.00 per acre payment on eligible crop acres, similar to the 1999 Program, up to a maximum of $5,600 per person. Farmers must have carried multi-peril insurance, crop revenue coverage, catastrophic insurance, or hail insurance on their 1999 crop for the acres to be eligible for the Assistance Payment. The Insurance Agent that sold the 1999 crop insurance policy will verify eligible acreage. There is no property tax refund option available with the 2000 Assistance Program.

Farmers must make application for the "2000 Agricultural Assistance Program" by September 30, 2000, to the Minnesota Department of Agriculture, 90 West Plato Blvd., St. Paul, MN 55107-2094. For more information or applications for the 2000 farm assistance program, persons should call the Department of Agriculture (1-800-967-2474) and ask for the "Agricultural Assistance Program".

Nitrogen For Soybeans This Summer ??

George Rehm, Extension Soil Scientist

In recent years there has been some promotion of the practice of applying nitrogen for soybeans after blooming, but during pod fill. Should this be a routine practice? Is it economical? What kind of response can be expected? These were questions that occurred to Minnesota soybean producers when they heard of this practice.

Various research projects conducted in the Corn Belt have been designed to evaluate the effect of the application of nitrogen fertilizer for soybean production. The results of those studies were inconsistent. Therefore, a research project was started in 1997 in an effort to evaluate the effect of nitrogen source and time of application on soybean yield in Minnesota. This project was ended after the 1999 growing season. Urea, a coated urea product, liquid urea, and ammonium sulfate (21-0-0-24) fertilizers were applied in June or July or August. The study was conducted at a total of 15 sites during the three growing seasons. All sites were in southern Minnesota.

Throughout the study, the use of nitrogen fertilizer did not increase soybean yield when compared to the control (soybeans not fertilized with nitrogen). The rate of application for all sources was 75 lb. of nitrogen per acre. The yields shown in Table 1 are typical of the results from this study. The use of ammonium sulfate, regardless of time and method of application had no positive effect on soybean yield.

Table 1. The effect of the application of nitrogen fertilizer on soybean yield.

Application Time	Method*	Yield
		bu./acre
control	-	53.4
preplant	broadcast	54.2
early bloom	broadcast	54.3
early bloom	knife	52.5
pod fill	broadcast	53.2

* N source was ammonium sulfate.

There is also a risk of yield reduction when nitrogen is applied during the growing season. The yields summarized in Table 2 show the yield reduction when liquid urea applied at pod set. The yield reduction associated with the foliar application at pod set was caused by leaf burn.

Table 2. The effect of the application of liquid urea on soybean yield.

Time of Application	Method	Yield
		bu./acre
control	-	45.1
early bloom	broadcast	42.3
early bloom	foliar	43.4
pod set	foliar	31.8

The results of this research project are not surprising if some basic facts about nitrogen and soybean production are recalled. These are:

- soybeans take up large amounts of N from the soil
- the N used is supplied from nodulation and the soil
- nodulation is reduced if there are excessive amounts of nitrate-nitrogen (NO_3N) in the root zone
- addition of fertilizer N late in the growing season adds to the amount of NO_3N in the root zone

After evaluating the results of this three-year study, it's obvious that there is a risk associated with the application of fertilizer N to soybeans during the growing season. The major risk involves economics. There is a very low probability that the money invested in nitrogen fertilizer will produce an increase in soybean yield. In addition, there is a strong possibility that the foliar application of nitrogen fertilizers could reduce yields.

The preceding discussion is applied to soybean production in southern Minnesota. From past research, there is some indication that the preplant application of nitrogen fertilizers will improve the yield of soybeans grown in the Red River Valley and northwestern Minnesota. Increases from N fertilization, however, have not been consistent.

Additional information from that region is needed before specific recommendations can be made. Additional information designed to refine the N recommendations for soybean production in northwestern Minnesota is being collected this summer.

USDA Farm Storage Facility Loan

Gary Wyatt, University of Minnesota Extension Educator
Watonwan County Extension

The proposed Farm Storage Facility Loan Program is on the Federal Register for a 30-day comment period ending June 12, 2000. It will be located on the web site, www.usda.gov, look under the FSA agency. Loans will be low interest (Treasury Securities) and intermediate term (7 years). Steel bins and flat grain storage are eligible for the loan while silage bunkers and hay sheds are presently not eligible. Applications will be available at FSA offices in June. Farmers who bought or built storage facilities between February 2, 2000 and May 30, 2000 may apply for a loan and may be approved if they meet eligibility and loan security requirements. For more information about the "Farm Storage Facility Loan Program", look on the web at: www.fsa.usda.gov/pas/fedreg.htm#Farm

Storage Facility Loan Program. Producers are asked to review the details of the program on the web and make their comments or suggestions to:

Grady Bilberry, Director,
Price Support Division
1400 Independence Ave SW
STOP 0512
Washington, D.C. 20250-0512

or

Chris Kyer via email: chris_kyer@wdc.fsa.usda.gov.

Beef and Dairy producers may like to share their comments regarding the eligibility of bunker silos and hay sheds. Contact your County FSA

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Warmer Temps, Watch Growth Regulator Applications

With warming temperatures, plants will begin to rapidly grow. Corn will quickly begin adding new leaves once past the second-leaf stage when nutrient uptake is rapid and photosynthesis cranks up as growing conditions hastening new leaf emergence. It is at this time, too, some of those later POST and the start of those POST-directed applications of growth regulator herbicides are being applied. With broadleaf weed competition beginning and corn not yet shading out weeds, this rapid growth phase in the corn plant coincides with the need for weed control and with the timing when plant growth regulators are at a high within the corn plant itself. Rapid growth of corn augmented with a growth regulator herbicide applied over the top or on the base of the plant, can cause brittle stalks in corn due to the accelerated growth. Good growing conditions further favor this rapid growth. Brittle plants formed and then subjected to high winds or very cool conditions quickly afterward can cause problems in fields. Wind can snap or shunt the plants over while very cool conditions can slow metabolism of the growth regulator through the corn plant allowing the brittle stalk stage to extend further into the season. Review weather forecasts, especially for the three to five days before and after application of growth regulator herbicides such as: 2,4-D, Shotgun, Banvel, Clarity, Distinct, Stinger, Hornet, Curtail, Celebrity, Celebrity Plus or NorthStar on corn. Continued good growing

conditions with mild winds will insure that corn plants can metabolize the herbicide quickly and will not be prone to brittle stalk problems. Also, check with your seed salesman to confirm that the hybrid is not more susceptible to stalk brittleness before using growth regulator herbicides.

Variety and Row Width Limit Use of Cultivation in Soybeans

Like corn, soybean roots slowly extend across the furrows limiting cultivation in this crop, often beyond the V3 stage. The third trifoliate in soybeans often is close to the time frame when cultivation should be completed in fields, depending on row width, variety and vigor of growth. With vigorous growth, especially in more bushy varieties, soybeans can be prone to not only root pruning but also to branch breakage with cultivation in narrower rows. Rows narrower than 21 inches require a skip-row pattern in order to cultivate and should be limited to cultivation up through the third trifoliate. Rows near this spacing and with more freely branching varieties (bushier) such as soybeans in 22-inch to 24-inch rows might also have cultivation completed before the fourth trifoliate is seen on the soybeans. Thirty-inch rows or wider can often be cultivated right up to the fourth-trifoliate in soybeans and sometimes a little longer, especially if root and branch growth has been limited by the season's conditions or a very upright variety is planted that has displayed limited root growth for the year. Before cultivating beyond the third trifoliate in soybeans, check your fields by simply taking a tiling spade (sharp-shooter shovel) and choose three random locations within the field to check to see if soybean roots have extended into the mid-furrow and if cultivation should be adjusted to a more shallow depth. Choose test locations off of turn-rows or compacted areas where limited root growth may not give you a good picture of true root extension across the furrows within the field.

Seeing Purple on Corn is not Necessarily Yield Robbing

With the advent of much of the cool night temperatures and daytime temps hovering below 75F over the last week, some corn may have begun to show purpling or even a little reddish color on leaves. Survey where you see the purpling and you shouldn'tbe surprised if you find that some hybrids show the leaf tinting and others do not. The purpling or reddening of the leaves is a mild form of phosphate limitation. Although soil reserves may be adequate, cool temperatures can slow uptake of the nutrient into corn, especially into specific hybrids. Uptake of not only P (phosphorus) but also of N (nitrogen) and K (potassium) are very slight in corn up through the second leaf stage, after which very rapid uptake occurs during the following vegetative and grain filling stages. If cool temperatures limit this uptake of P, a very mild P limitation may show on certain, genetically similar hybrids. With returning warmer weather and moisture in many areas to hasten good growing conditions, this purpling of the corn leaves should quickly dissipate within two weeks. This mild P deficiency at the second to third leaf stage will probably not affect yield. Corn continues to determine total number of rows on the ear through the fifth leaf stage and will not finalize the length of each row on each developing ear until the twelfth to fourteenth leaf stage.

Scouting Corn from Emergence to Knee-High

Scouting corn is key to keeping the crop healthy throughout the season. Few diseases have cropped up this year, but other symptoms may have been seen. If corn shows plant tissue removed, it might be an insect pest you should be watching. Black cutworms can cut whole plants off at the ground level and can be found in or near freshly cut plants especially when the crop is near a grassy ground cover area such as edges of fields and near shelterbelts. Corn leaves that are entirely eaten off or large chunks of leaf tissue are removed, check for armyworms or grasshoppers. Ragged holes in the leaves could indicate slugs, black cutworms in the early larval instar or even very early European corn borers. Make sure the plants were not affected by shattered hail damage, too. Shredding or tearing of leaves could indicate hail or even wind damage. Rows of circular to elliptical holes across the leaves may reveal stalk borers or early European corn borers or simply a passing billbug. Dry conditions in which corn leaves show irregular tracks of scratches may indicate corn flea beetles or aphid

presence. Watch for the "window effect" on leaves where the area between the upper and lower leaf surface is eaten out as corn blotch leaf miners may be present or later European corn borers could be tunneling along leaf midribs. Excessive moisture around a growing corn plant can cause general yellowing of lower leaves and purpling or reddening of leaves from the tip backward that affects lower leaves first may indicate a phosphorus deficiency, compacted soil, cold weather, white grubs or even dinitroaniline residual injury. Flag areas where you see concerns and check these areas daily, if possible, to see if the problem area shows corrections in plant health or if control measures should and can be taken.

Cure Cocklebur with Cunning

Common cocklebur is a clever weed that is native to the region and cloisters two achenes in a bur. Germination of both seeds can occur but light inhibits the basal seed while the distal seed requires light for germination. The minimum temperature for the basal seed germination is just above 71F but the minimum temperature for the distal seed to germinate is 77F, allowing the adaptable weed to seed germination and limit control by early, low-residual herbicides. Bur degradation or exposure to established conditions is necessary to allow any seed germination. Seeds stored in the bur can remain viable for more than five years if in a cool, dry location. Once outside the bur, seeds remain viable for only a few days. Integrated weed management practices against cocklebur slowly cure fields from cocklebur problems. Exposure of burs to adverse winter conditions can eliminate some of the weed seed bank; however, integrating inter-row cultivation allows herbicide rates, areas of application or even both to be reduced without reducing soybean yield. And, control concentrated on cocklebur over multiple years can cause emergence patterns to be more uniform, making control with herbicides easier. The common cocklebur is a highly variable weed species and can adapt to situations and changes in environment. Consider some of the stronger POST herbicides at this time to control wide-spread cocklebur infestations with such chemicals as: Basagran, Rezult, Flexstar, FirstRate, or Raptor (after first trifoliate is fully expanded).

Plant Disease Clinic

Sandra Gould, Assistant Scientist

Samples submitted to the Plant Disease Clinic in May included:
alfalfa--*Fusarium* sp and *Phoma* sp crown rot
barley--tested for loose smut
silage--cultured for storage molds
wheat--cultured for storage molds
catalpa--*Verticillium* sp wilt
apple--fire blight
tomato--powdery mildew, bacterial leaf spot
rose--*Paratylenchus* sp, *Pratylenchus* sp nematodes, *Coniothyrium* sp canker
dahlia--dahlia mosaic virus
impatiens--impatiens necrotic spot virus (INSV)
geranium--*Pythium* sp root rot
verbena--bacterial leaf spot
petunia--Pythium sp root rot
jack-in-the-pulpit--rust

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In this Issue

Hail Injury on Small Grains

Ervin Oelke, Extension Agronomist

During the past week, several small grain fields in the southern part of the state have had some hail injury. Most fields were planted in mid-to-late April and by now (May 24th) would be in the advanced tillering to early jointing stage of growth. Hail damage in small grains at the early stages of growth is difficult to assess. The terminal bud of small grains remains below or at the soil surface before jointing. Thus the terminal bud usually is not damaged by hail and it will continue to develop and produce a head or panicle after hail damage. Also, new leaves should develop especially from the tillers. The main tiller or stem is generally ahead of the tillers and if it has jointed and has been broken off below the terminal bud, the main tiller would not produce grain. However, the other tillers generally compensate for this yield loss. Generally, there is limited yield loss from hail damage before jointing. Maturity could be delayed from early hail damage and weeds such as foxtail could be more of a problem in early hail damage. The weed growth needs to be watched and controlled if necessary.

Hail damage after jointing and during flowering can reduce yields especially if the flag leaf is lost from hail. However, the lower leaves, if not damaged, can compensate some for loss of the flag leaf. The flag leaf is important in grain filling. The loss of all flag leaves during anthesis (flowering) may result in a yield loss of 10 to 15%. If the stems are bent or damaged, the heads have difficulty emerging from the boot resulting in the tips of the heads caught in the boot. After heading, hail damage results in greater yield losses by breaking off heads or shattering kernels. Yield losses are generally proportional to the number of heads or kernels lost. For more information on growth and development of spring wheat and spring barley, see AG-FO-2547, Growth and Development Guide for Spring Wheat, and AG-FO-2548, Growth and Development Guide for Spring Barley.

Efficient Fertilizer Use For Alfalfa

Lisa Behnken, Extension Educator, Olmsted County
Tim Wagar, Area Extension Educator, Crops and Soils

The key to efficient forage production begins with representative soil samples that have been analyzed for pH, P (phosphorus), and K (potassium). This basic combination of soil tests along with a realistic yield goal are all that is needed to determine ag-lime and fertilizer recommendations for alfalfa in a large part of Minnesota. Other nutrients such as sulfur (S) and boron (B) may be required in specific field situations, particularly where coarse textured sandy soils predominate.

Often times, greater amounts of fertilizer are recommended for alfalfa than are agronomically needed. These excess recommendations only result in greater costs for the farmer and provide no agronomic benefit to the alfalfa. This is especially the case for livestock producers who have consistently used manure on their cropland. Those farmers have attained high soil fertility levels in their fields due to a history of manure applications that have provided a wide range of essential crop nutrients for the soil. Thus, the basic soil fertility requirements for optimum alfalfa production are to maintain a soil pH of at least 6.5 and to have sufficient soil P and K levels.

An on-farm strip plot demonstration with alfalfa was conducted in Olmsted County during 1998 and 1999 to compare fertilizer rates recommended by a mid-west crop consulting service and the University of Minnesota Extension Service. The field was divided into three strips, 1) North and South = consultant fertilizer recommendation and 2) Middle = University of Minnesota Extension Service fertilizer recommendation. The soil type was Mt. Carroll silt loam and the fertilizer rates for the strips were applied after first cutting each year. The field had been highly managed for years. Manure was applied when the field was planted to corn and commercial fertilizer was applied when it was in alfalfa. Yields were determined by the "windrow method" where three random six feet lengths of windrow were weighed and the average weight calculated for each strip. A composite sample of alfalfa representing the three strips was taken to determine harvest moisture content. The following tables show the comparison.

Soil Test Information And Fertilizer Rates Suggested

1998

Crop Consulting Service yield goal - 5.5 tons/A		U of M Extension Service yield goal - 7 tons/A	
Soil Test 9/5/96*	Recommendation	Soil Test 6/2/98**	Recommendation
pH - 7.1	none recommended	pH - 7.2	none recommended
P - 57 ppm	183 lbs. DAP/A	53 ppm	none recommended
K - 278 ppm	227 lbs. K2O/A	121 ppm	105 lbs. K2O/A***
Mg - 255 ppm	100 lbs. Mg/A		
S no	10 lbs. S/A		
Mn results	7 lbs. Mn/A		
B reported	14 lbs. B/A		

* Background soil sample of site taken by consulting service

** Background soil sample of site taken by U of M Extension Service

*** The potash rates recommended in 1998 by the Extension Service were higher than the amounts listed in the U of M fertilizer publications due to the greater bulk required by broadcast application equipment.

For the 1999 crop year the farmer decided to apply fertilizer rates on the north and south strips that did not include micronutrients. The University of Minnesota Extension Service recommendation was 175 lbs. K2O/A for 1999.

Alfalfa Yields

1998 & 1999

1998 totals for second (7/2), third (7/27), and fourth (9/1)cuttings

North Strip - 1.7 + 1.5 + 1.5 = 4.7 tons DM/A (Consultant)
Middle Strip - 1.8 + 1.4 + 1.4 = 4.6 tons DM/A (UM)
South Strip - 2.2 + 1.5 + 1.6 = 5.3 tons DM/A (Consultant)

1999 totals for all four cuttings: 5/26, 6/30, 7/31, & 9/1

North - 2.9 + 1.6 + 1.4 + 0.9 = 6.8 tons DM/A (Consultant)
Middle - 2.9 + 1.6 + 1.4 + 0.8= 6.7 tons DM/A (UM)
South - 2.7 + 1.6 + 1.3 + 0.8 = 6.4 tons DM/A (Consultant)

Although, the mid-west crop consulting service recommended substantially greater amounts of fertilizer compared to the U of M Extension Service, alfalfa yields were similar after two years. The total average yield obtained with the consulting service information was 5.8 tons/A compared to 5.65 tons/A achieved with the Extension Service fertilizer suggestions.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Water Availability Key to Corn Growth

Soil water availability can lead to better yields in corn. Research run in the 1960s showed that the transpiration rate of corn begins to diminish after soil water potential hits the breaking point of -0.2 bar at specific stages of corn growth. At this low level in the soil, the corn is no longer well supplied with water and this soil-imposed restriction reduces the water use within the plant. With this decreasing soil moisture availability, the rate of evapotranspiration is reduced below the optimum potential for good plant growth. Corn is most affected by water restrictions during silking and tasseling and then, next, during grain fill. However, young corn plants must also have moisture available within the upper soil surface in order to grow optimally and develop a root system that adapts the plant for moisture fluxes during the season. Wetting and drying trends as seen this year are helpful in developing strong, extended roots on young corn plants that will benefit the plant later if conditions turn dry. Current conditions are very good for corn in most of the Valley region. Continue monitoring fields for weed pressure to eliminate unnecessary weed use of field moisture.

Ahhhhh, Rain Right on Time

The recent rain over the Memorial Day holiday was needed in much of the Valley. Just emerging soybeans and growing corn were boosted in growth with the moisture. The Northern Valley region could benefit by additional rain this week. Much of the corn is in the V2 to V5 leaf stage. The roots of the corn plant on the first whorl are elongating and quickly followed by elongation of the roots on the second whorl. Leaf and ear shoots are being initiated and by V5 the potential ear shoot number is determined on the corn plant. Also by V5 the tassel is initiated at the growing point. Average height of a corn plant at V5 is about eight inches. The growing point is at or just under the soil surface. Much of the soybeans in the Valley are just emerged, VE, or starting into the first trifoliolate, V1. The cotyledons supply nutrient needs for the plant for seven to ten days just before the first trifoliate shows on the soybean plant. With good to excellent conditions, including adequate moisture on the soil surface until roots are established at deeper depth, new growth stages should make an appearance on soybeans every five days. Active nitrogen fixation should begin occurring in soybeans once the second trifoliate appears on the plants. Warm soil temperatures along with adequate moisture will insure that good nodulation can occur this year in the Valley. Limit cultivation to only those fields that show crusting or weed problems that can't be eliminated with herbicides in order to conserve moisture. Careful cultivation on corn past the V5 stage is needed in order to not destroy roots as the corn plant will now be beginning to extend its root system across the furrow.

Stages of Crops Suggest Scouting

Some of the very early planted corn in the Valley will just be entering a crucial scouting period. Corn into the fifth-leaf stage is at a growth period when several insects should be monitored through to corn silking. Once past 700 borer degree days (base 50F), European corn borer should be checked. Although moth traps have indicated low numbers for the Valley, in the Midwest corn borer numbers are just beginning to be mentioned, especially on some of the stressed corn fields. Corn at the fifth-leaf stage should also be checked for damage from corn rootworm, true armyworm, fall armyworm, and limited potential damage from lingering stalk borer, black cutworm, white grub or wireworm problems. So far damage has been low. Disease has not really been a problem thus far on corn. Soybeans have also had limited problems with disease. Timely rains in much of the Valley has insured good emergence, except in the drier regions to the North on the North Dakota side of the Red River. Check soybeans for root or lower stem chewing by wireworms or white grubs although little has been reported. Watch the nodulation process on soybeans once they enter into the second trifoliate of leaves. Good conditions should insure excellent nodule development on soybeans this year. Review the weed pressure seen in fields and determine best control to minimize weed competition to the crops.

Early Invader is Showing

Yellow foxtail is distinctly erect and stiff as compared to other foxtails. It is often one of the early invaders on "go-back" land as well as prominent in field in the early stages of corn emergence on cropland. Providing poor forage value after maturity, the weed is only moderately palatable and just fair for forage even when rapidly growing, limiting its use even on rangeland. The hairless sheath of the grass weed is distinctly flattened making the identification easier on this weed. Often seen after 250 to 400 growing degree days, this weed has optimum germination between 68F to 77F. While light enhances germination, this weed can germinate in the dark. Seeds can remain viable even after 33 months of dry storage but dark germinated seed usually have only 30% of the total germination as compared to light activated weed seed. Best depth for germination of yellow foxtail as tested was shown to be right about at two inches with less germination suggested when the weed seed was exposed within the first inch of the surface soil. However, yellow foxtail can produce numerous seed that once returned to the weed seed bank can create years of problems in cropland where this grass is a problem.

Know Your Soils-Barnes Soil

The Barnes soils are very common in Eastern North Dakota, Northeastern South Dakota and into Western Minnesota. The classic soil profile includes a dark, gray loam on the surface that is above first a brown loam horizon then a light gray to light yellowish brown loam underneath. The calcium carbonate levels in this deep horizon can range from 10 to 25 percent. The depth to this lime layer is around 10 to 23 inches. Barnes soils are well drained, unlike the heavier Fargo clays. Most of the Barnes soils are level to slightly undulating and used as cropland. In the more hilly and rolling areas of Barnes soils, hay and pasture may exist. Native vegetation often seen on Barnes soils that are not used for cropping include: western wheatgrass, needle and thread, green needlegrass and blue grama. Few engineering limitation exist on most Barnes soils. Formed in calcareous loamy glacial till, the Barnes soils usually exist in areas where the annual precipitation is around 15 to 20 inches and the average annual air temperature is 38 to 45F.

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MINNESOTA
CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In this Issue

Grain Protein and Spring Wheat Production

George Rehm, Extension Soil Scientist

Minnesota spring wheat producers are always searching for ways to make a profit. In years when it appears that a premium might be paid for a higher percentage of grain protein, there is considerable interest in management practices that might be used to enhance grain protein. Since both nitrogen and sulfur are key components of protein, there are always questions about the effect of using additional fertilizer during the growing season.

The potential for using additional N to improve the percentage of grain protein in spring wheat has been the focus of considerable research for many years. The timing of various commonly used nitrogen fertilizers has been evaluated in several trials in Minnesota. The results of the research efforts, however, have not been consistent.

The general approach of the Minnesota research efforts has been to apply N over and above the amounts needed for optimum yield. The additional N has been added N at the boot, tiller, or head emergence stages of development. After conducting this study for 3 years using several locations each year, there were no consistent results that could be used to substantiate any recommendations.

Leaf burn is a serious concern if N is applied as 28-0-0 and the rate of N applied is higher than 40 lb. Per acre. In addition, only small amounts of N are absorbed through the leaf tissue. The large majority of N used by the wheat plant is absorbed through the roots. Therefore, rainfall after fertilizer application will be needed if N applied during the growing season is to be used by the plants. This timely rainfall is not always guaranteed in Minnesota.

More detailed research conducted under irrigated conditions in California has shown that N applied during the growing season will increase if grain

protein is applied somewhere between head emergence and bloom. At this point in the life cycle of the spring wheat plant, additional N is used to increase the percentage of the protein in the grain rather than to increase vegetative growth. In Minnesota, this delayed application of N will only be effective if there is rainfall to dissolve the fertilizer and move the nitrogen into the root zone.

Liquid fertilizers containing both nitrogen (N) and sulfur (S)_ have also been evaluated as a potential management practice to improve grain protein. Results of these evaluations have shown that the use of N and S did to increase grain protein.

Currently, research is under way to measure the effect of slow-release N fertilizers on grain protein. The results of this research effort will be available during the winter of 2000 - 2001.

2000 Ag Professional Field School

Kevin Cavanaugh, IPM & Ag Professional Program Coordinator

The 2000 Ag Professional Field School will offer two Sessions, which will be held at the Southern Research and Outreach Center-Waseca. Session I will run July 11-12 and Session II will run July 13-14. Both Sessions will be identical in content.

This is a hands-on, in-field program emphasizing corn, soybean and alfalfa management skills. Participants will have the opportunity to enhance their troubleshooting and crop management skills in specially designed plots that display actual cropping situations. The Field School is targeted towards sales people in seeds, chemicals, fertilizer, crop consultants, crop production specialists, agronomists, and county extension educators. A total of 12 CEU have been requested for this program. Each Session will offer the following: Soil and Water Management, 2.5 hr; Pest Management, 7.0 hr; Crop Production, 2.5 hr.

Participants will be placed in small groups based on their professional experience. The registration fee is $275.00 and registrations must be received by June 30, 2000. The Field School brochure includes the registration information and will be mailed out next week. To receive a program brochure and registration information, contact Tracey Benson at (612) 624-3708 or 800-367-5363. If you have questions regarding program content, contact Mike Schmitt at (612) 625-7017 or Kevin Cavanaugh at (612) 625-2778.

General session topics and instructors will include:
Session I & II, July 11-14

Soils Properties and Crop Production, John Lamb, Neal Eash, Gyles Randall, Lowell Busman, Jeff Strock, Carrie Laboski-University of Minnesota; Bob Schoper, Agriliance

Weed Identification, Beverly Durgan, University of Minnesota

Field Crop Diagnostics, Kevin Cavanaugh, Dale Hicks, Paul Porter, Dan Martens, Seth Naeve, Lisa Behnken, Mike Schmitt

Weed Management, Jeff Gunsolus, Tom Hoverstad-University of Minnesota; Eric Spandl-Agriliance

Entomology, Ken Ostlie, Bill Hutchison, Eric Burkness,, Fritz Breitenbach, Bruce Potter-University of Minnesota

Weed Identification

Kevin Cavanaugh, Dept. of Agronomy & Plant Genetics

Are you challenged identifying an unknown weed in your field? Many times I am as well

despite all the references I have on hand to assist me in correct weed identification. In any identification process, good samples are key to making a fast and correct identification. However, even supplying a good sample will not eliminate the challenge of an easy identification. For example there are about 30 Nutsedge and Golden Rod species each in Minnesota. In the early growth stages of these plants, correct identification of these can be very difficult to distinguish to a specific species. When plants mature to their flowering stage, then identification becomes easier.

In addition to sending plant samples for identification, digital photos of the weed you wish to be identified can be sent in by email. If you choose this option, keep in mind that only good photos showing important characteristics of the plant will be useful. If you are unfamiliar with using digital camera for identification, I suggest you practice with taking closeups of plant parts before sending photos by email. Good digital photos have to be CLOSEUP and show the entire plant, stem, leaves, and flower parts. About three to four good quality photos depicting the plant's characteristics and the general location (1 photo) where found are usually necessary to assist me in identification

If there is a weed identification problem that cannot be solved locally, you can follow the instructions below and mail the plant species to me. Please note that this service is for commercial agriculture and NOT homeowners. (NOTE: homeowners see address at end of article for where to send weed samples for identification).

- DO NOT place weeds in plastic bags or wrap in plastic. Plants will turn to mush in the mail.

- DO NOT tape weeds to paper or manila folders.

  Put the plants in a fold of a paper towel or newspaper. Press overnight under the weight of a heavy book and mail them in the paper. If necessary, plants can be gently folded to accommodate the envelope.

- Mail all plants samples at the beginning of the week. This will help to avoid having the plant samples sit in the post-office over a weekend.

- Send at least two samples of the entire plant that include the top growth of the plant-stems, leaves, and the flowers and/or fruits, if available. Roots are not normally needed for identification of older plants. However, if sending weed seedlings or vegetative plants please send the entire plant.

- Include background information about the plant: perennial, annual, biennial (if known), where found (in what crop?, near a wetland, edge of field, soil type, sunny/shady location, etc.)

- Include your name address, phone number, and/or email.

Send weed samples to address below:

Kevin Cavanaugh
Department of Agronomy & Plant Genetics
411 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108

Digital photos can be sent by email:

cavan008@umn.edu

Information on weed management, herbicide application, and timing can be found in the University of Minnesota Extension Service publication BU-3157-S Cultural and Chemical Weed Control in Field Crops-2000. Check with your county Extension office for this publication

Homeowners: **WEED IDENTIFICATION**
Follow the above guidelines when sending samples in mail for identification. The Yard and Garden

Clinic charges $5.00 for identification. Check with your University of Minnesota County Extension Office for a Master Gardener who may be able to identify the weed FREE before sending in a sample to Yard and Garden.

Send Samples to:
Yard and Garden
University of Minnesota
155 Alderman Hall
1970 Folwell Ave.
St. Paul, MN 55108

Alfalfa Insect Update

Bill Hutchison and Eric Burkness
Extension Entomologist, and Scientist, respectively

Before Harvest-- As shown in the table below, alfalfa weevil(AW) infestations continue to grow at our Rosemount site; Bruce Potter also reports high infestations at other southern Minnesota locations such as Lamberton. At Rosemount we are now approaching 35% of the stems infested. This is close to the 40% threshold of obvious weevil feeding damage, but with only 0.85 larvae per stem, does not justify treatment (at bud stage). Also, much of the southern Minnesota alfalfa is very close to cutting, e.g., within the next 7-10 days, for anticipated "1st-flower" timing, and/or based on Relative Feed Value (RFV) estimates. I therefore do not anticipate the need for insecticides for control at this time. Two logistical issues also come in to play at this time: a) PHI (pre-harvest interval) for many insecticides is 7-14+ days, and b) the damage that will be done by driving through the field to spray. Fields infested with high AW infestations should be cut as soon as possible during the next 7-10 days.

Weevil Degree-Days and Alfalfa Weevil Infestations (#/50 sweeps), Rosemount Agric. Expt. Station, contrasting spring 1989 ("early spring", dry year), and spring 2000.

1989			2000		
Date	Dds	AW/50Swps	Date	Dds	AW/50Swps
			5/2	210	0.5
5/7	193	0.9	5/6	301	20.0
			5/9	350	55.0
5/15	284	1.0	5/15	402	322.5
5/22	409	15.0	5/22	469	580.0*
5/27	490	151.0			
5/31	543	314.0			

*The current sample, averaging 580 larvae/50 sweeps is now showing approx. 35% of the stems infested, and avg. 0.85 larvae/stem.

Review of Alfalfa Weevil Thresholds, for "Early Bud" Stage, when late-instar weevils are active, see:

http://www.ipm.iastate.edu/ipm/icm/1999/4-26-1999/alfwhatch.html

After Harvest - Fields infested with weevils, before cutting, should soon be checked carefully for weevil survival (e.g., under the windrow). Larvae will typically congregate and continue to feed on the cut hay, or stubble regrowth under the windrow. Based on what we have at Rosemount, there is a very real potential for significant feeding damage to occur on the regrowth; ALL fields should be checked carefully. An approximate threshold is 6-8 larvae/square foot. A more dynamic threshold that incorporates the value of the hay, and cost of application, is available from the Iowa State Newsletter (see article) at:

http://www.ipm.iastate.edu/ipm/icm/1998/5-25-1998/oddend.html

For more info. on sampling/scouting for alfalfa insects (to view, or order hard copy) of the fact sheet, "Sampling Alfalfa Insects," go to:

http://www.extension.umn.edu/distribution/cropsystems/DC3516.html

Insecticides labeled for alfalfa weevil, 2000.

Insecticide	Rate/ac	PHI (Days)
Ambush 2E*	6.4-12.8 fl oz	0 for 6.4 oz or less; 14 otherwise
Pounce 3.2E*	4-8 oz	0 for 4 oz or less; 14 otherwise
Baythroid 2*	1.6-2.8 oz	7
Furadan 4F*	0.5-2pt	7-28
Lorsban 4E	1-2 pt	14-21
Penncap-M*	2-3 pt	15
Sevin XLR+	2-3 pt	7
Warrior T or 1E	2.6-3.8 oz	1 (forage); 7 (hay)

*Restricted Use Pesticide (RUP); check the label for other restrictions, including PHI for specific rates, Restricted Entry Interval (REI, e.g., 24 hrs).

Notes: To avoid/minimize bee kills, do not treat alfalfa during bloom. Also treat between 5pm-dusk, or very early in the morning, to use insecticides when bees are least likely to be exposed (early am applications are also recommended to minimize drift, via lower wind speeds). Treatment of fields that contain blossoming weeds or other plants, can also result in severe bee losses.

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MINNESOTA
CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 9 **www.extension.umn.edu** **May 19, 2000**

In this Issue

Plant Pest Survey Program

Mark Abrahamson, State Survey Coordinator
Minnesota Department of Agriculture

Expanded services of the Plant Pest Survey Program at the Minnesota Department of Agriculture will help farmers keep tabs on potential pests. The Plant Pest Survey is a scouting program designed to quantitatively estimate pest populations in major Minnesota field crops. Data for pest populations in field corn, soybeans, small grains, alfalfa and sunflowers are entered into the Plant Pest Survey Database daily, and are available to the agricultural community throughout the growing season at our website:

http://www.mda.state.mn.us/pestsurvey

With the 2000 growing season underway, the website has several new and improved features available. Among these is a search-by-crop feature that will retrieve maps of current pest abundances around the state. Moreover, the database now has an expanded set of searching capabilities that will allow the user to retrieve a statistical summary or download a raw data set of particular pests abundances. The website also contains fact sheets for Minnesota crop pests and an extensive set of links to other agricultural websites.

The Plant Pest Survey Database contains records from 1994 to present. Survey data collected by our survey specialists will be transmitted daily from the field and uploaded into the database. The quickest way to receive this information is to join our electronic mailing list.

Members of the electronic mailing list will receive our weekly newsletter "The Minnesota Pest Report" as well as semi-daily updates on pest abundance. If you would like to join our mailing list, please contact: Mark Abrahamson, State Survey Coordinator, Minnesota Department of Agriculture, 90 West Plato Blvd, St. Paul, MN 55107, Phone: 651-296-6509, fax: 651-297-3631 or e-mail: Mark.Abrahamson@state.mn.us.

Stand Counts in Small Grains

Jochum Wiersma, Small Grains Specialist

Taking a stand count early in the season when the crop has emerged is a good practice. It allows for an evaluation whether seedbed preparation and planting went as planned and whether the intended stand can be achieved. The easiest time to do a stand count is probably when the crop is in the two- to three-leaf stage since tillers are not visible yet and thus counting is easier.

To do a stand count, use one of the following two methods:

1. Count the number of plants in a foot of row at several locations in the field. Take an average and convert in plants per acre using Table 1.

2. Take a hula-hoop, let it fall, and count the number of plants inside the hoop. Repeat this at random several times across the field and calculate an average. Use Table 2 to convert the count to an approximate population per square foot or acre.

Table 1. Average number of plants per foot of row for different row spacing and plant densities per acre.

	Plants per acre (times 1 million)							
Row Width	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
6"	9.2	10.3	11.5	12.6	13.8	14.9	16.1	17.2
7"	10.7	12.1	13.4	14.7	16.1	17.4	18.7	20.1
10"	15.3	17.2	19.1	21.0	23.0	24.9	26.8	28.7
12"	18.4	20.7	23.0	25.3	27.5	29.8	32.1	34.4

Table 2. Adjustment factors to multiply the number of plants inside a hoop and convert the number in to number of plants per acre.

Hoop Diameter	Multiply by
30"	8,900
32"	7,800
34"	6,900
36"	6,200
38"	5,500

Uneven Corn Stands

D.R. Hicks, Extension Agronomist

Variable moisture and temperature conditions may cause corn seed to germinate and emerge unevenly. The question is "Does uneven emergence affect corn grain yield?"

We simulated uneven corn emergence in a field study by planting half of the seeds (every other plant hill) either 7 or 14 days later than the first or early planted seeds. When 50% of the plants in the stand emerged 7 days later, yield was reduced 5%. With 14 days later emergence for half of the stand, yield was reduced 13%.

In another study yield was reduced 6% when 1/4 of the stand was delayed by 10 days in emergence and 8% when half of the stand was delayed by 10 days to emerge.

Based on these studies, corn grain yield is not likely to be greatly affected with uneven emergence when only a small percent of the plants are delayed and particularly if the emergence is not delayed by more than one week.

Crop Production Tips

Denise McWilliams, Extension Crop Production Specialist

Wild Oats Like Cool, Moist Conditions

Look back across the years and consider the environmental conditions that increased wild oat production in your fields. More than likely, you can equate the recent few years of cool, wet springs with wild oat seed bank increases. Wild oat prefers cool springs and areas where moisture is retained. In fact, this grass weed in laboratory testing had good germination at 70F but failed fairly uniformly at 81F. Germination was enhanced by moisting seed or by rupturing the seed coat that otherwise can cause seed dormancy. The minimum temperature for seed germination generally is 61F and the maximum temperature for any great seed germination is 81F. Light is not needed for germination. Exposing seed to the winter environment on the soil surface or deep burial may prevent weed emergence. Remember that burying seed requires many more years before weed seed viability is sapped. Wild oats are easily recognized by the panicle more open than in tame oats. The fibrous roots are limited in protecting the weed, unlike other weeds that have rhizomes. New growth supplies wild turkeys, deer, pronghorn and prairie dogs with early, spring food. Better control of this weed in corn can be obtained with soil applied PPIs of atrazine, DoublePlay or the older Eradicane being phased out as well as with a POST of Accent, Accent Gold (on 88-day hybrids or later), atrazine, Basis Gold (on 88-day hybrids or later), Celebrity Plus, Liberty (on Liberty-Linked corn), Lightning (on Clearfield corn), or Roundup (on Roundup-Ready corn). In soybeans, consider POST applications of Assure II, Fusilade DX, Fusion, Poast, Select/Prism, Liberty (in Liberty-Linked soybeans), Raptor, Rezult, Roundup (in Roundup-Ready soybeans) or Touchdown (in glyphosate-resistant soybeans).

Plan Soybean and Pest Strategies Now

Optimize soybean yields by choosing varieties that are within the maturity range for your location. Planting a number of varieties that vary slightly in relative maturity not only allows harvest to be spread out, but often helps reduce pest and harvest losses. Keep an eye open for early pests which affect soybeans. Scout for root rots (pythium, rhizoctonia, fusarium and phytophthora) as well as looking for any signs of iron chlorosis. Very early insects which affect soybeans may include: seed maggots, wireworms and slugs. Early weeds can also rapidly decrease yields if not kept in check. Consider the estimated yield reductions from some of the major weeds in soybeans shown on the following table when determining and evaluating your proposed weed control program:

	% Soybean Yield Loss					
Weeds	1%	2%	4%	6%	8%	10%
	(# of weeds or clumps/100 foot squared)					
cocklebur	0.4	0.8	1.6	2.4	3.2	4
pigweeds	0.8	1.6	2.4	4	6	8
lambsquarters	0.8	1.6	2.4	4	6	8
morningglory	3.2	6.4	9.6	12.8	16	20
volunteer corn	0.4	0.8	1.2	1.6	2	2.4

(Information from University of Illinois Field Crop Scouting Manual and Ohio State University.)

Now that Your Corn is Planted Remember Early Effects on Corn Influence Later Development

With much of the corn planted in the Red River Valley, remember the first few stages of corn growth will set the tempo of the hybrid health and yield. Starting with emergence, the corn plant develops primary roots and by the second leaf stage (vegetative stage--V2) has first whorl roots elongating. By V4, the plant has second whorl roots elongating with these nodal roots already a major part of the root system. At this same time, the growing point is still below the soil surface. However, leaf and ear shoots are already being initiated. This initiation will be complete by V5 (five-leaf stage). Also by V5, a microscopically small tassel has been initiated at the growing point. Soil temperatures can greatly affect the corn development even with the growing point below ground. Colder soil temperatures (below 50 F) can increase the time between leaf stages, delay tassel formation and reduce nutrient availability. The growing point, however, is protected from hail, wind or frost while under ground. Unfortunately, the growing point is not protected from flood. Remember that early weed control is also important. Weeds compete for water, nutrients and light. Chemical control, cultivation and higher plant populations or crop rotation can reduce weeds. If cultivation is used, shallow cultivation after V2 is important as deeper cultivation will destroy nodal roots.

Early Versus Late Soybean Risks

If soybeans were planted early in the Red River Valley before the recent rains and very cool temperatures, surviving seedlings that were protected underground may show delays in emergence. Fungicide use may help prevent early disease in the cool, wet soils or increased seeding rates may maintain populations to reasonable levels. Root diseases, however, are still a concern in soybeans. Phytopthora and Rhizoctonia are two root diseases that may cause seedling damage or death, unless predicted warm temperatures slow the development of these diseases. Timely cultivation can help dry soils in the upper surface and reduce root rots while promoting root development and preventing soil crusting this year, if needed. Carefully monitor early planted soybean fields for losses in low or wet areas if soybeans were emerged and temperatures in your area dropped below 28F. Good soil temperatures before the recent cool air temperatures may modify damage in early germinated soybean fields.

Consider Early Pests in Corn Before Planting

Several pests attack corn during emergence and into early plant growth stages. Consider the problems you have seen in your fields in previous years in order to strategize and customize your pest management and scouting plans. Early diseases which attack corn include: seedling blights, Stewart's bacterial leaf blight, anthracnose leaf blight and crazy top. Early insects include: flea beetles, seedcorn maggots and beetles, white grubs, wireworms, cutworms and slugs. Early weeds can also take away from corn yields. Several weeds may also have multiple flushes of seed germination making the use of short residual herbicides limited in scope on the corn field. Yield reduction from weeds can cut into yields especially when crop prices remain low. Consider the general threshold information on two of the common weeds found in North Dakota when making your weed pest plans and while scouting:

Weeds	% Yield Reduction Expected					
	1%	2%	4%	6%	8%	10%
	(number of weeds/100 ft of row)					
	#	#	#	#	#	#
Cocklebur	4	8	16	28	34	40
Redroot Pigweed	12	25	50	100	125	150

(Weed affects are additive, if more than one weed add the effects to get total reduction.)

(Sources: University of Illinois Field Crop Scouting Manual, Ohio State University, North Dakota State University.)

Farm Storage Facility Loans To Be Available

Kent Thiesse, U of M Extension Educator

USDA has announced that the "Farm Storage Facility Loan (FSFL) Program" will be available from County Farm Service Agency (FSA) Offices, beginning on May 30, 2000. Through the FSFL Program, farm operators will be able to get seven year, low interest loans through the Commodity Credit Corporation (CCC) to build or upgrade grain storage facilities and handling equipment. This is some long awaited, good news to farmers that have been counting on this program as a financial tool to add or upgrade the grain systems in their operation in 2000.

Farmers must meet a series of eligibility requirements before their FSFL loan application is approved by FSA. This includes traditional loan eligibility requirements such as credit rating, security agreements, and ability to repay the loan. It also includes a requirement to carry multi-peril crop insurance and compliance with Federal environmental policies on farm land. Producers must also be in compliance with local land use and zoning ordinances.

Traditional grain storage facilities, such as bins, silos, and flat storage are eligible for the loans, provided the facility has a useful life of 10 years or more. The low interest loans can also be used to finance improvements in existing grain storage structures, as long as the storage capacity is increased. The FSFL loans can also be used to purchase and improve grain drying and handling equipment, including concrete aprons, pits, and pads, as well as grain safety and monitoring equipment. Farmers may borrow a maximum of 75 percent of the net cost of the eligible facilities or equipment, up to a total maximum loan amount of $100,000.

Farm operators that plan to use the FSFL Program to finance grain storage facilities or handling equipment should hold off signing any purchase orders or taking delivery of any building materials until after their FSFL application has been approved by the FSA Office. Failure to comply with this could result in farmers being ineligible for the loans. Producers that purchased or took delivery of grain storage facility materials between February 2nd and May 11th, 2000 are eligible to make applications for FSFL loans after May 30th at County FSA Offices, and could be eligible to to receive a FSFL loan , if all loan criteria are met. Farmers with questions on FSFL loan eligibility and requirements should contact their County FSA Office.

Farm operators are encouraged to discuss potential grain storage and handling additions and upgrades with their Ag Lender prior to making application for a loan at the FSA Office. The FSFL Program is a good opportunity to add or improve grain storage facilities and handling equipment. It is also an opportunity for producers that are considering more production of specialty crop varieties and identity preserved grains to adjust their grain storage system to meet these management requirements.

Remember ... just because there are low interest loans available, does not mean that it is in the best interest of every farmer to add more grain storage facilities. Make sure the grain storage facility upgrades fit the long-range plans for your farm operation.

Corn and Soybean Regrowth after Frost and Hail Injury

D. R. Hicks, Extension Agronomist
S. L. Naeve, Extension Agronomist

Low temperatures during the past few nights (May 12, 13, and 14) caused some leaf injury to corn and maybe to soybeans. Several reports today indicate corn leaf injury from completely across much of Minnesota. Soybeans are just emerging and there haven't been confirmed reports on injury, but some probably occurred. We expect regrowth to occur without a major loss in stand for both corn and soybeans.

Corn. Substantial leaf injury can occur without any loss in stand providing good growing conditions (warm temperatures) continue for the next few days. New leaves should emerge from the corn whorl pushing the older frost damaged and dead leaves away. The growing point (source of new leaves) is located about ½ inch below the soil surface and is not likely to have been damaged by the low temperatures (possible, but not likely unless the low temperature continued for several hours such that the soil around the growing point dropped below 32 degrees). New growth should be

visible the day after the frost if the temperature is above 65 degrees. The stand can be evaluated in a couple of days to determine if some plants are not going to survive and regrow.

Should post emergence herbicides be applied now? Probably not. The corn needs to recover some with new leaf tissue and be actively growing to metabolize the herbicide. That should occur within 2 to 3 days if we have good growing conditions, especially warm temperatures.

Soybeans. Soybeans can tolerate air temperatures that are lower and for a longer period of time without showing frost injury than can corn. There are several growing points on the soybean seedling. The terminal growing point (GP) is the dominant one and is located at the top of the main stem. New leaves will grow from this GP on a normally developing soybean plant. When the terminal GP is damaged (by frost or removed when eaten by rabbits or deer), regrowth can occur from the vegetative buds (growing points) located in the leaf axils on the main stem. The axils are the points where the cotyledons are attached to the main stem and where the petioles of the unifoliolate and trifoliolate leaves are attached. Seedling soybeans (at the growth stage where soybeans are now) will have two vegetative buds in the cotyledonary axils. Regrowth can occur from either of these vegetative buds if they have not been frozen. Often the terminal GP can be frozen without injury to the GP's located in the leaf axils. We expect frosted soybeans should regrow from one of these GP's. Depending upon the severity of the frost injury, some plants might not survive resulting in some stand reduction. However, this should not have a significant effect on soybean yield unless there are gaps in the row where all plants have been killed.

There have also been reports of some hail injury in Southwest Minnesota associated with rains that came in the evening of May 15. Hail injury at this early growth stage effects corn and soybean much like frost injury mentioned above. Again, regarding corn, the growing point is currently below the soil surface in fields planted at an adequate depth. With warm temperatures, you should expect new leaves to begin pushing though damaged tissues soon. The crop may be set back only a few days.

Although we have not yet heard reports of severe hailstorms, such events can be more damaging to a soybean crop, at this stage. Soybean plants cut off below the newly emerged cotyledons will die. If severe hail damage is noted, the remaining healthy stand should be quantified. In addition to the stand estimate, also consider that soybean seedlings are probably continuing to emerge in recently planted fields. Even at this early calendar date, replanting soybean fields should be considered only if significant stand reductions have occurred.

Alfalfa Insect Update

Bill Hutchison, Extension Entomologist
Eric Burkness, Scientist

Potato Leafhopper-- This past week, one of the recent rainfall events seems to have brought us our first Potato Leafhoppers (PLH) of the year (3/100 sweeps). I know you will all be excited to hear the news. PLH migrations to the upper Midwest occur primarily by High Pressure storms from the east, converging with Low Pressure storms from the west. The more storms that converge over MN, the more PLH we will have. The window for this activity is anytime between April 15th to June 15th, for the FIRST migration event. As we know from last year, we can have MANY separate migration events, bringing new adults to our state throughout the summer. This is a normal time for PLH to come in, often near the end of the first crop of alfalfa, and not typically developing economic infestations until the 2nd or 3rd crops. Hopefully, we will not have a year like last year, or at least more storms will converge over WI; we will keep you posted.

Alfalfa Weevil-- Alfalfa weevils continue to increase in number, at our Rosemount, MN (Dakota Co.) site, now reaching 322 larvae/50 sweeps. HOWEVER, at this time, this is not considered to be an economically damaging level of weevil activity; only 15% of the stems are actually infested, with larvae or obvious feeding damage (mixed range of larval instars; 1st to 3rd). As I indicated in last week's article, cool, wet weather will slow down weevil development and preferentially favor alfalfa growth. As soon as the last article hit the press, the cooler weather kicked in. Most alfalfa quality samples coming in from southern locations, and at our Rosemount site, indicate much of

the crop is in early bud stages, and will soon be approaching optimum cutting time. I therefore do not expect any (or very little) insecticide being applied this year, prior to the first cutting.

Having said that, I do anticipate the possibility of control being needed after the first cutting. However, this can only be determined by careful scouting.

Insecticide control will only be justified if the 2nd crop is:
a) not "greening up" within 5 days of harvest, due to continued weevil feeding, and/or cutworm feeding, especially under the windrows (assuming adequate moisture, nutrients available), and/or, b) potato leafhoppers (0.5/sweep) and/or plant bugs (3-5/sweep), are present.

Weevil Degree-Days and Alfalfa Weevil Infestations (#/50 sweeps), Rosemount Agric. Expt. Station, contrasting spring 1989 ("early spring", dry year), and spring 2000.

1989			2000		
Date	Dds	AW/50Swps	Date	Dds	AW/50Swps
			5/2	210	0.5
5/7	193	0.9	5/6	301	20.0
			5/9	350	55.0
5/15	284	1.0	5/15	402	322.5
5/22	409	15.0			
5/27	490	151.0			
5/31	543	314.0			

Note: The current sample, averaging 322 larvae/50 sweeps is still limited to only approx. 1% of the stems infested.

For more info. on sampling/scouting for alfalfa insects (to view, or order hard copy) of the fact sheet, "Sampling Alfalfa Insects," go to:

http://www.extension.umn.edu/distribution/cropsystems/DC3516.html

For more info. on a threshold ("worksheet") for estimating the need to treat "stubble alfalfa", following the first cutting, see the 1998 article by Rich Pope, Iowa State University, at:

http://www.ipm.iastate.edu/ipm/icm/1998/5-25-1998/oddend.html

More information will be available regarding insect pest management for alfalfa this spring.

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MINNESOTA

CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 8 **www.extension.umn.edu** **May 12, 2000**

In This Issue

Rotary Hoeing: Tips and Techniques

Jerry Doll, Extension Weed Scientist
University of Wisconsin-Madison

It's been a few years since I have written on this topic and with all the planting that has and is occurring this spring, a few reminders may be of help. Rotary hoeing will be particularly important if preemergence herbicides do not receive a rain within a week or so of planting. Pay close attention to the time between seedbed preparation and the preemergence herbicide application. If it has been 10 days or more since seedbed preparation, and little or no rain has fallen to activate your preemergence herbicide, rotary hoe as soon as possible. If you applied a preplant incorporated herbicide, there should be no need to rotary hoe unless you need to break a crusted soil to enhance crop emergence. Rotary hoeing fields with preemergence herbicides does not incorporate the herbicide appreciably. The primary effect is to kill small weeds. Hopefully rainfall will follow within a few days of hoeing to activate the herbicide to then kill the next generation of weeds.

For those who use no herbicides, timeliness of rotary hoeing is especially important. Rotary hoeing can appropriately be called "blind tillage" because you shouldn't see much of the effect you are having. Once the weeds have emerged and turned green, you are two steps behind in effective use of the rotary hoe. Many people say to rotary hoe 5 to 7 days after planting. In years with cool springs, crops and weeds develop slowly and this is often too soon to be effective. One way to decide when to rotary hoe is to monitor crop development, as well as the calendar. We suggest the first rotary hoeing be done when the corn shoot is half an inch below the soil surface (assuming a 1.5-inch planting depth). This way we are letting the developing corn seedling act as a measure of growing degree days and weed seed germination and emergence will be correlated to that of the crop. Best results with rotary hoes are obtained when soils are relatively dry and you are hoeing in the hotter part of the day.

Conservation tillage leaves considerable crop residue on the soil surface, and questions regarding the feasibility of rotary hoeing fields with 30% or more crop residue often arise. We have not seen any cases where chisel plowed or disked fields have too much residue to rotary hoe. A few have rotary hoed no-till fields where the soil is light textured. This can work if the previous crop was soybeans, but no-till planting into last year's corn will probably plug standard rotary hoes, and may even plug minimum-till hoes, especially if the stalks are wet.

However, the root systems of last year's corn plants can plug the wheels of any rotary hoe. Periodically check to see that the teeth are not plugged with old corn roots, clods resulting from working fields wet, or rocks. On way to reduce such plugging is to drive faster. The increased centrifugal force will "clean" some of the old roots and clods; of course do not drive faster than safer for the terrain of the field.

Another question regarding rotary hoeing is crop damage. When done before corn or soybean emergence, few if any plants are damaged. The most vulnerable time that hoes may cause injury is when the crop is one to two inches tall. Once the corn has leafed out and the beans are past the "crook" stage, they have little ability to "reemerge." Check carefully when rotary hoeing crops one to two inches tall to be sure that few, if any, are being covered with soil. Adjust tractor speed and rotary hoe depth to correct any problems. But don't worry about losing a few plants, especially in the case of soybeans. If you are killing weeds by hoeing, the benefit will exceed the loss of a few plants.

Finally remember that perennial weeds like quackgrass, yellow nutsedge, and Canada thistle will not be suppressed by rotary hoeing. And a few large seeded annuals like shattercane and velvetleaf. Thorough cultivation and /or herbicides should be used for these and similar species.

CCC Loan And LDP Deadline is May 31st

Kent Thiesse, U of M Extension Educator

May 31, 2000 is the final day that farm operators can put corn and soybeans that were produced in 1999 under a nine month CCC loan at County Farm Service Agency (FSA) Offices. May 31st is also the deadline to claim any loan deficiency payment (LDP) on any 1999 corn and soybeans. That is also the final date to verify and provide proof of 1999 corn and soybean production to County FSA Offices. This proof determines the bushels eligible for CCC loans and LDP's.

The May 31st deadline is very important to farmers that have 1999 corn and soybeans in storage that is not currently under CCC loan or is not sold for future sale. This is the only grain that is eligible for a potential LDP. As of May 5th, there was no LDP on either corn or soybeans. However, if market prices drop during the month of May, there could still be potential for an LDP. The greatest potential to possibly still earn a n LDP is on soybeans, because the posted county price is very close to the CCC loan rate.

Producers with unpriced corn and soybeans in storage might want to consider putting the grain under CCC loan, even if they plan to sell the grain this Summer. This strategy will provide some downside price protection, if market prices decline in the coming months. If the posted county price is lower than the loan rate, producers can release the grain under loan at the lower price and then sell the corn or soybeans. Grain can only be placed under CCC loan once and grain that is placed under loan is not eligible to earn a LDP. Farmers with questions on CCC loan or LDP eligibility should contact their County FSA Office

Continued Dry Weather A Concern

Kent Thiesse, U of M Extension Educator

The continued lack of rain and the extremely warm temperatures during the past week have heightened concerns about a potential drought during the 2000 crop year. Many areas of South Central Minnesota did not receive any significant rainfall from April 21st to May 5th and temperatures during the first five days of May rose to the upper 80's. The high temperatures and extended lack of significant rainfall this year are probably more pronounced than 1987. 1988, and 1989, which were very dry Springs. This is the driest springtime conditions in many parts of Southern Minnesota since 1976, according to Kent Thiesse, University of Minnesota Extension Educator.

Thiesse said that according to official SWCD rain gauge measurements, most areas of Blue Earth County received less than 1.0 inch of total precipitation during April, with some parts of the region receiving less than one-half inch total. Normal April rainfall in the area is about 2.75 inches. One of the measurement sites in Southwestern Blue Earth County has recorded only 7.32 inches of total precipitation from August 1, 1999 to April 30, 2000, a period of nine months. That would represent about 40 percent of the normal precipitation during that period. Total precipitation amounts in northern and eastern parts of the county during the same nine month period were 3 - 5 inches more, which is still only 50 to 70 percent of normal.

Thiesse indicated that farmers are facing a duo concern of topsoil that is rapidly drying out and shortages of stored soil moisture. The extremely warm temperatures, combined with some moderate wind have significantly dried the topsoil in the planting zone, especially in fields that have not received significant rainfall in the past ten days to two weeks. This will likely lead to uneven and poor germination in some soybean fields, if we do not receive a significant rainfall very soon. Most of the corn had adequate moisture to germinate and emerge.

Thiesse points out that the amount of available stored soil moisture around South Central Minnesota is highly variable, just as the total precipitation last Fall and this Spring has been. The University of Minnesota Research and Outreach Center at Waseca had initial reports of stored soil moisture in the top five feet of soil being at 85 - 90 percent of capacity. The University research site at Lamberton reported only 25 - 35 % of capacity for stored soil moisture on May 1st. Based on field reports, Thiesse feels that the stored soil moisture situation in Western Blue Earth County and surrounding areas is probably more similar to Lamberton than Waseca Another problem in the driest areas is that most of the stored soil moisture is below the three foot level.

So, if we do not get some timely rainfalls early in the growing season it may be difficult for young corn and soybean plants to access a majority of the stored soil moisture.

Thiesse said the good news is that corn and soybeans across the region were planted at a "record pace". Virtually all of the corn in the area was planted by May 1st and over half of the soybeans were planted by May 5th . Actually, some growers quit planting soybeans late last week to wait for rainfall and cooler weather to continue planting. Thiesse says that is almost "unheard of " for farmers to quit planting in May because temperatures are too high. Most of the corn had germinated by May 5th, with most corn emerging 7 to 10 days after planting. Normally in early May, it takes corn 2 to 3 weeks for corn to emerge.

Alfalfa fields have come out of dormancy and are progressing quite rapidly due to the very warm temperatures. The first cutting of alfalfa will likely be one to two weeks earlier than normal in many areas. In the very dry regions, rainfall will be needed soon to avoid yield reductions from the first cutting of alfalfa.

*** NOTE --- Most of South Central Minnesota received .50 to 1.50 inches or rain early Monday morning, May 8th .

Daily Crop "ET" Available on the Internet

Jerry Wright, Extension Engineer

Producers and crop consultants in Minnesota and Wisconsin needing daily crop ET information for irrigation scheduling can access the internet at the following address to obtain the past day's daily ET potential estimations:

Minnesota & Wisconsin (potential ETs only):
http://bob.soils.wisc.edu/wimnext/water.html

The map presents the daily ET estimations across the state via color contours placed over the map of the two states. Information is updated 7-days a week and continues through September. Each daily map remains stored on the internet page and is access able any time. **The daily values for a given field site within the map area can also be sent directly to a user by e-mail each day if requested over the WEB site.**

Each daily map gives a reasonable estimation of the potential (reference) ET value across the area based on the weather conditions of that day. The daily potential ET value is very similar to the daily crop ET from a full cover alfalfa crop of 6 to 10 inches in height.

These potential ET daily contour maps are generated using data from local airport automatic temperature recording stations across the state and solar radiation estimations calculated from a GOES satellite that takes a picture about every 10 minutes to estimate the daily solar radiation for a given location. A comparison of the last two years values with ET estimations from local weather stations at Staples and Morris has found them to be similar but about 10 percent greater in value than reported by local ET hotline services.

The daily ET maps are created and managed by University of Wisconsin Extension Soils Scientist, Bill Bland. This daily ET value must be taken times a crop coefficient (Kco) constant that is dependent on the growth stage of the specific crop. Generally, once a plant's canopy has nearly closed the

Kco is equal to one. For some crops however this Kco may become slightly larger to around 1.1 during a crops' critical growth like with corn between late pollination and early dough stages.

Keeping track of the crop's daily ET use and regular in-field soil moisture checking can go a long ways in helping an operator optimize the crop's growth while reducing the potential for leaching of some crop inputs like nitrogen into the groundwater.

These daily ET values best serve the user if recorded down on a calendar log like an irrigation checkbook worksheet or computer spreadsheet for quick reference when making your irrigation decisions.

For more information on how to use daily crop ET information contact Jerry Wright, Extension Engineer at the West Central Research and Outreach Center at Morris, MN by e-mail at **jwright@tc.umn.edu** or by phone at 320-589-1711.

Check Alfalfa for Weevils

Bill Hutchison, Extension Entomologist
Eric Burkness, Scientist

As indicated by degree-day forecasts, 1st and 2nd instar Alfalfa weevil (AW) and/or Clover Leaf Weevil (CLW) larvae are now present throughout some central and southeastern Minnesota counties. The recent warm, dry weather has been very conducive to weevil development for at least two reasons. Although AW has a higher developmental threshold (48F), compared with alfalfa (approx. 41F), the warmer weather allows the weevil to get a "jump on" spring growth of the alfalfa canopy, such that there is a risk of more weevil feeding damage prior to the first harvest. In addition, the dry weather also tends to minimize the biological control provided by fungi. In more normal, or cool/wet years, alfalfa growth tends to outpace weevil development, and the fungi have a greater impact.

For southern Minnesota, we are currently at approx. 350-400 degree-days (DDs); for central MN, ca. 300 DDs. Most of the larvae we are finding are still in the 1st or 2nd instar, which matches the DD forecast. For daily updates on AW degree day accumulations for MN and WI, you can view a map on the UW/MN Climate Web site at (bookmark this for future reference):

http://bob.soils.wisc.edu/wimnext/alfalfa/alfweevil.html

The degree to which AW or CLW actually reach economic levels is still dependent on continued favorable weather (for weevils) between now and anticipated first-cutting dates, time until the first cutting, AND the weather immediately after the cutting. Scouting activity should be scheduled accordingly. Much of the alfalfa is now between 12-20" tall, and may be able to be cut before significant feeding damage occurs. Given the data below for Rosemount, now is good time to scout for weevil infestations, check the vegetative/bud development of your stand, and consider treatment decisions.

Degree-Days and Alfalfa Weevil Infestations *(#/50 sweeps)* at Rosemount Agric. Expt. Station, contrasting spring 1989 ("early spring", dry year), and spring 2000.

	1989			2000	
Date	DDs	AW/50S	Date	DDs	AW/50S
			5/2	210	0.5
5/7	193	0.9	5/6	301	20.0
			5/9	350	55.0
5/15	284	1.0			
5/22	409	15.0			
5/27	490	151.0			
5/31	543	314.0			

Note: The current sample, averaging 55 larvae/50 sweeps is comparable to ca. 0.35 larvae/stem. (see stem-based thresholds below).

Scouting and Management Guidelines:

1- First check recently established stands, and south-facing slope stands (these may receive more damage, and/or have earlier infestations).

2- Use a sweep net to quickly determine presence/absence of weevils; if weevil larvae are present, or > 10/sweep (50/50 sweeps), you should take a stem sample to obtain a quantitative estimate of the damage, that can be compared to economic thresholds (we recommend 5 sets of 10 sweeps each for sampling).

3- Stem sampling can be used for comparison with either of the following thresholds:
   a) Quick (static) threshold: 40% of the alfalfa stems (typically terminal, bud area) show obvious defoliation by weevil larvae (i.e., larvae still present and actively feeding on the stem), and IF > 7-10 days from harvest, an insecticide treatment should be considered; more information using this approach is available at the WI web (degree day) site mentioned earlier. OR,
   b) Dynamic economic threshold: this is based on recent data from Iowa State University; this incorporates larval density/stem, expected value of the hay ($60, to $100/ton), and growth of the stand. Dynamic thresholds range from approx. 1.0 to >4.0 larvae/stem, depending on the value, height of alfalfa, etc.

Complete info. on the Dynamic Threshold is available in the recent newsletter article by Marlin Rice, Iowa State University, at:

http://www.ipm.iastate.edu/ipm/icm/2000/4-24-2000/scoutalf.html

Despite the favorable weather to date, and the fact that AW infestations have increased this past week, I am not concerned at this point, that we will have significant economic infestations. In addition to mortality from fungi, we have an excellent complex of beneficial parasites (non-stinging wasps) that attack both the adult and larval stages of the weevil. Although the contribution from the biological control complex can vary from year to year, recent data have documented substantial increases in overall parasitism in Minnesota during the past 10 years.

Finally, most of the alfalfa should still reach maturity before the weevil complex reaches economically damaging levels, OR alfalfa on a given farm that has the highest weevil counts, should be cut first (and possibly early, if necessary) to avoid insecticide use, and provide some weevil control. However, all early-cut fields should be checked carefully for adequate regrowth during the 5-7 days after the cutting to ensure that weevils are not continuing to survive and feed. More info. on regrowth management will be provided in upcoming issues.

For all you ever wanted to know about alfalfa weevil, the fungi, and diverse parasitoid complex in Minnesota, see:

http://ipmworld.umn.edu/chapters/flanders.htm

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

As Corn Emerges, Scout Fields

So far optimum conditions have existed for corn planting and germination. With emergence, check fields to insure corn is coming up without problem pests. Reports from the Midwest show that insects are showing up and areas that have a field history of such problems as cutworms are seeing the insects. Here in North Dakota, scout and watch fields that have a field history of cutworm damage, particularly those fields that maintain residue cover such as minimum or no-till fields. Scout carefully for cutworms in bottom lands or low spots and where drainage is less than optimum especially if near-by grassy areas exist. Scout for cutworms once the corn is up until mid June. Consider treatment when 3-6% of the plants are cut and small larvae are present. Also, watch for crusting problems on emerging corn once again when soil dries from the recent rain for late emerging corn. Corn planted one to two weeks ago should just be emerging with the first leaves showing. Periods of dry weather have allowed seed to germinate without root rots surfacing in the Valley. However, while scouting for cutworms, watch emerging corn and plant populations especially in those fields with low spots or heavier clay textures. If field areas are slower to emerge, dig up some of the seed to see if germination is proceeding without problems.

Conditions Optimum for Seeded Soybeans

Warming soil temperatures and another rain this weekend is promoting soybean emergence in fields seeded in the last week. Forecasts for cooler night temperatures, show cooler but not freezing conditions confirming excellent conditions for soybeans in the Red River Valley. Watch low areas of the field or poorly drained spots for problems as soybeans quickly emerge. Cooler conditions could promote some root or early seedling diseases in these spots as well as continue

weed emergence from weed seed in these problem areas. Due to rapid moisture imbibing by the soybean seed, soil temperature will be an important factor in promoting stand establishment. Maintaining warm soils will allow soybeans to emerge and will promote the transition from germination to active photosynthesis by the plants once they are emerged. Growing degree day units continue ahead of normal for this season and if warm conditions continue will allow crop plants a good start into the season.

Now that Your Corn is Planted Remember Early Effects on Corn Influence Later Development

With much of the corn planted in the SE region of ND and in the southern Valley region of MN, remember the first few stages of corn growth will set the tempo of the hybrid health and yield. Starting with emergence, the corn plant develops primary roots and by the second leaf stage (vegetative stage--V2) has first whorl roots elongating. By V4, the plant has second whorl roots elongating with these nodal roots already a major part of the root system. At this same time, the growing point is still below the soil surface. However, leaf and ear shoots are already being initiated. This initiation will be complete by V5 (five-leaf stage). Also by V5, a microscopically small tassel has been initiated at the growing point. Soil temperatures can greatly affect the corn development even with the growing point below ground. Colder soil temperatures (below 50 F) can increase the time between leaf stages, delay tassel formation and reduce nutrient availability. The growing point, however, is protected from hail, wind or frost while under ground. Unfortunately, the growing point is not protect from flood. Remember that early weed control is also important. Weeds compete for water, nutrients and light. Chemical control, cultivation and higher plant populations or crop rotation can reduce weeds. If cultivation is used, shallow cultivation after V2 is important as deeper cultivation will destroy nodal roots.

Provide Protection against Proso

Proso millet also known as broomcorn millet or wild millet is a grass weed that reproduces by seed. The seed, once part of the weed seed bank in a field, easily germinates with very little dormancy or light controls affecting germination. Testing revealed that proso would germinate at soil temperature of 50F to 104F with very little problems. Optimum germination temperature was right around 86F. Seeds of this weed collected in the autumn and stored at room temperature for four months still had 86% germination at 86F in complete darkness. A strong competitor in corn fields, the young seedling can resemble volunteer corn in other crops but is a hairier seedling and the ligule (flap of leaf sheath tissue) has a noticeable fringed membrane. Prolific at seed production, seed easily shatters and is often spread on or by harvest equipment in the fall. Although a good winter and brood-rearing cover for upland birds, this weed is persistent in crop land and should be controlled. A few of the corn herbicides that can prevent field infestation include PRE Balance, Balance + Harness/Surpass or Epic before corn emergence. Suppression of proso millet can be obtained with POST applications of Accent, Accent Gold (use on 88 day or higher maturity corn), Basis Gold (use on 88 day or higher maturity corn) or Celebrity Plus. Roundup-Ready (labeled glyphosate products), Liberty-Linked (Liberty herbicide) and Clearfield (Lightning herbicide) corn can also be used with their suggested POST treatments to control wild proso millet.

Swing Shift Your Weed Seed Bank

It would be nice if you could pick and choose the weeds you have in a field, if weeds have to be there. Choosing more easily controlled weeds over difficult weeds might be possible if you understand the conditions that drive weed populations, shifts and mortality. Indeed, weed population shifts occur every time management practices change or as the environment changes with the growing seasons. One strategy is to shift weeds from the active to the dormant part of the seed bank. Deep burial of weed seed can prevent emergence, although weed seed do generally live longer at deeper soil depths. Buried long enough, weed seed do eventually lose viability. Careful use of tillage can bury weed seed and even prevent or reduce resurfacing of the seed. A second strategy is to keep the weed seed on the soil surface to encourage weed seed germination for quick chemical control or to simply expose seed to harsh environmental conditions to decrease weed seed viability. No-till and minimum tillage encourage shallower weed seed distribution. A third strategy is to rotate the use of herbicides that are effective to the more troublesome weeds. This prevents resistant weeds and will ensure the problem plants are getting hit with a variety of effective chemical controls as well as any other management practices that might lower weed seed problems.

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MINNESOTA

CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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IN THIS ISSUE

New CRP Incentives Available

Kent Thiesse, U of M Extension Service

USDA recently announced that $350 million dollars in new financial enhancements would be available to landowners that participate in the "Continuous Conservation Reserve Program (CRP) Signup". The new federal funding will be used to provide an up-front signing bonus and to provide additional cost-share dollars for installing and maintaining conservation practices. These new financial incentives may have some merit for landowners that were considering CRP as an option on qualifying land parcels.

The new enhancements for the Continuous CRP signup are available as of May 1, 2000, and are being administered through County Farm Service Agency (FSA) Offices. The main incentive is an up front signing bonus of $10.00 per acre for each year of the CRP contract. CRP contracts must be a minimum of 10 years and can be a maximum of 15 years, so the signing bonus will be $100.00 - $150.00 per acre enrolled in Continuous CRP. The one time payment will be made after the CRP contract is approved and all payment eligibility criteria are met.

The other payment is an additional 40 percent cost-share dollars for installing approved conservation practices on the Continuous CRP land parcels. The payments will be made for practices approved by the Natural Resource Conservation Service (NRCS). The additional 40 percent payment is in addition to the 50 percent cost-share that already exists for installing conservation practices under the Continuous CRP Program. There are also new rental rates on marginal pasture land that is in riparian areas and is eligible for the Continuous CRP signup. USDA has set a Maximum limit of $100 million for 2000 and $125 million for 2001 and 2002 for the Continuous CRP enhancements.

USDA is offering the new incentives because participation in the Continuous CRP Program have fallen short of the 4 million acre goal established as part of the "Clean Water Action Plan". To be eligible for Continuous CRP signup, cropland must have been planted or been considered planted to an agricultural crop in two of the past five years. Marginal pasture land that could be used as a "riparian buffer" may also be eligible for the program. Annual CRP per acre rental rates are based on average cash rental rates for cropland in a given area. These rental rates are set and are not negotiable. There is an additional 20 percent added to the annual CRP rental rates for implementation of certain conservation practices. Landowners should contact their County NRCS Office regarding eligibility and to find out the annual CRP rental rates of various land parcels.

Conservation practices that are eligible for the new Continuous CRP enhancements include filter strips, riparian buffers, grass waterways, field windbreaks, shelter belts, living snow fences. Thiesse feels that these new incentives for Continuous CRP may be quite attractive for landowners that have land parcels that are in environmentally sensitive areas and are marginal for crop production. Some farm operators in areas, such as the Minnesota River Basin, have been considering alternative land uses on these types of crop land.

Landowners can get more details and information on the Continuous CRP enhancements and other rules for Continuous CRP signup from County FSA and NRCS Offices. County Offices of the University of Minnesota Extension Service can also assist landowners with financial and management decisions related to CRP signup.

Corn Planting Nearly Completed

Kent Thiesse, U of M Extension Service

Approximately 90 percent of the corn in South Central Minnesota has been planted by the end of April, which is probably one of the highest amounts ever. Most of that corn was planted from April 21st to April 28th, over about a seven or eight day period. This may be the shortest period ever for planting a majority of the corn crop in Southern Minnesota, according to Kent Thiesse, University of Minnesota Extension Educator.

Thiesse said the combination of warm weather and excellent soil conditions allowed for the ideal planting conditions that lead to the record pace of corn planting this year. Most farm operators in South Central Minnesota were able to plant the corn into moisture. The adequate soil moisture combined with soil temperatures of 60 degrees or greater has allowed for rapid germination of the newly planted corn. Soil moisture is depleting rapidly once the soil has been tilled.

Most parts of Southern Minnesota remain extremely dry. Rainfall last week was very spotty, with many areas receiving only trace amounts of rainfall. However, there were some locations fortunate enough to receive nearly an inch of rainfall. There has not been enough rainfall in any part of the region to significantly improve stored soil moisture, which ranges from "short" to "extremely short" across Southern Minnesota.

Thiesse indicated that some farmers started planting soybeans last week, while others chose to wait until after May 1st to initiate soybean planting. University of Minnesota Agronomists feel that soil conditions are very good for soybean planting, even though we are one to two weeks earlier than normal. Adequate topsoil moisture for soybean germination could become a problem in some areas that have received limited rainfall.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop production Specialist

A Little Dab will Do You

The recent, mild sprinkles of rain were just what the corn plant ordered. Corn planted before the April 30 shower is well on its way to optimal progress. Spoon-fed rain, like the slight shower on Sunday, is perfect for just planted corn. Growing degree days are a little ahead of normal this year which will also help corn germination and emergence. The influence of weather on the corn plant starts even before planting. Soil moisture reserves and temperature both effect seed germination as well as insect and disease problems. Corn from planting to emergence is greatly dependant

on soil temperature, soil moisture, soil aeration and seed vigor. With warmer temperatures, less water has to be absorbed by the seed to start germination and thus this process will start earlier and proceed faster with warming temperatures when water is also available. Corn germinates best at temperatures greater than 50F wh a sharp decrease in germination below 50F. Germination speeds up as soil moisture increases until saturation when the lack of oxygen in soil pores prevents or retards germination. Corn takes 18 to 20 days to germination at 50-55F, but only 8 to 10 days at 61-64F. With moist soil and an average temperature near 70F, emergence may occur in 5 to 6 days.

Corn Planting on Target

Corn is being seeded through the Red River Valley and proceeding quickly with weather perfecting planting conditions. Recent warm soil temperatures (above 50F) last week and dry surface conditions just on the ground's top only mildly offset planting progress with this Sunday's early morning sprinkles of rain. Subsoil moisture remains excellent. Corn planted prior to the April 30 rain, has begun to germinate and appears to be growing optimally with the excellent conditions. Lack of insects and disease so far has made the crop start out with better than normal growing conditions. Watch for insects once the corn plant has emerged. Conditions in the dry Midwest have promoted billbug and midge feeding on the corn that is up. Mild winter conditions here too may dictate later insect problems, especially if dry conditions further south move insects up or promote emergence in the Red River Valley. The southern end of the Valley had more rain two weeks ago than other regions and that left potholes of moisture standing in clay fields in Traverse County, MN but even these fields should be attempting to finish corn planting.

Corn Emergence Best if Nursed with Rain

Early vegetative growth of corn is very sensitive to water stress. Stress shortly after emergence decreases the starch and chlorophyll content of seedlings. Some drying of soil, however, is important in that it causes the corn roots to penetrate deeper into the soil and the plant will be able to better withstand later dry weather. Young corn plants are relatively resistant to cold weather until stage V6 when six leaves have fully emerged and the growing point is just above ground. Optimum shoot growth as well as leaf elongation occur at temperatures between 77-95F. Flooded conditions limit both root and shoot growth in corn. Corn grown in the northern High Plains has shown better leaf area (potential for better grain fill) and growth with increased May rainfall up to a total of 5 inches. Above this amount, yields were decreased. Periodic, soft showers on planted corn in May would optimize the early season growth in the Red River Valley.

Treat Soybeans with Care

Soybean varieties differ in ability to emerge at different soil temperatures and depths of planting. All varieties germinate and emerge at 85F but some are limited below 59F. Target soil temperatures of 60F or above for optimum planting conditions. Plant soybeans a maximum of 2 inches deep, trying to optimize planting depth to only 1-1.5 inches. Soybeans should never be planted in dry soil. A minimum seed moisture uptake required to germinate soybeans is 50%. Soil should be sufficient to allow soybean seed to imbibe water, but not too cool or too flooded. Soil moisture levels too high with low temperatures allow soybean seeds to be attacked by soil fungi and decay. Be careful when moving or loading seed to the planter. Soybean seed is very fragile, more than most seed. A 10% reduction in germination can occur simply from throwing soybean seed out of a truck and onto a concrete floor or onto hard ground. Try not to let seed fall more than a foot when handling for planting. Test any saved and stored seed for intactness of the soybean seed coat, germination under stress, germination percentage and seed viability prior to planting.

Perennial takes Advantage of Minimum Tillage

The wild four-o'clock weed is a perennial that is native to the United States. Reproducing by seed, the weed utilizes warm temperatures to flower during May through October. Reaching a mature height of 1-4 feet depending on moisture and temperature, the vegetative growth conceals a large, thick, fleshy and tough taproot that is the real pernicious factor in providing four-o'clocks with a foothold in fields. The pink or reddish-purple (very occasionally white) flowers that are each a separate calyx (fused sepals) rather than a flower with individual petals will eventually evolve into brown to yellow seed that readily germinate under the correct conditions. Flowering only in late afternoon and closing the flower in early morning, this weed protects itself by rarely invading cultivated fields. Easily controlled by cultivation or herbicides, this weed usually is not dense enough to be a problem but is increasing in no-till and minimum tillage corn and soybean fields. Watch for this weed culprit in roadsides, pastures, rangeland, disturbed but none tilled sites as well as in minimum tilled fields.

What do the Numbers Say?

Zachary Fore, Extension Cropping Systems Specialist

I have been looking at a lot of crop production numbers lately, and I have been focusing on the available data for the 1990's - 1990-98. Making sense of thousands of numbers is difficult, so I have tried to summarize the data in the following table.

Crop Production Data from Northwest Minnesota: 1990-1998*

Crop	Average Acres/yr	Average Yield	Average Yield During Highest Yielding Year	Average Yield During Lowest Yielding Year	Average Loss vs. Highest Yield	Coefficient of Variation (%)	Long Term Average Price	Loss-Million $/Yr
Corn	112,511	72 Bu/A	102 Bu/A	37 Bu/A	25 Bu/A	36	$2.41/Bu	$6.8
Soybeans	298,467	27 Bu/A	35 Bu/A	21 Bu/A	7.2 Bu/A	17	$6.19/Bu	$13.3
Wheat	1,689,689	35 Bu/A	50 Bu/A	25 Bu/A	15.25 Bu/A	28	$3.89/Bu	$100.2
Barley	483,989	57 Bu/A	76 Bu/A	50 Bu/A	20.25 Bu/A	16	$2.10/Bu	$20.5
Sugarbeets	254,600	17.4 T/A	21.8 T/A	13 T/A	4.7 T/A	11	$38/T	$45.5
Dry Beans	53,633	1293 lb/A	1683 lb/A	800 lb/A	443 lb/A	23	$0.19/lb	$4.5
Sunflowers	209,233	1340 lb/A	1782 lb/A	1058 lb/A	508 lb/A	22	$0.12/lb	$12.8
3,102,122						**Total $ Impact/yr =**		**$203.7****

*Source: Minnesota Agricultural Statistics: Northwest Minnesota
**Average Loss = $65.64/A

Different people may see different things when they look at this data. Take a hard look at the numbers and see if your interpretation is similar to the interpretation I give below.

Average Acres/Yr: We grow a lot of wheat in the region, although not as much as we did a few years ago. Trend data shows that acres of soybeans and dry beans have increase dramatically, while acres of barley and sunflowers have decrease dramatically.

Average Yield: Nothing to brag about. The 90's have not been overly friendly to production.

Average Yield During Highest Yielding Year: I call these 'Attainable Yields' for the region. We know they are attainable because we have achieved them. This is what we should shoot for as a realistic goal each year. Again, the 90's weren't overly friendly to the region, so these are truly 'attainable' yields.

Average Yield During Lowest Yielding Year: We certainly can have (did have) some disastrous yields during the 90's.

Average Loss vs. Highest Yielding Year, and Coefficient of Variation: These columns show us which crops had the highest and lowest yield variation during the 90's. Higher variation means higher risk, lower variation means lower risk. During the 90's corn, wheat, dry beans, and sunflowers were risky crops. Sugarbeet was a very stable crop. If we can identify the causes of this variation we can implement practices that will reduce it. So what were the major causes of low yields during the 90's? Here are my picks:

1. Excess water. Most farmers in the region indicate that excess water was far and away their #1 yield limiting factor during the 90's. Sugarbeet and soybeans appeared to tolerate excess water better than the other crops. Corn appeared to be particularly sensitive to excess water.
2. Disease. Scab had a major impact on wheat yields, and white mold and other diseases had major impacts on sunflowers and dry beans.
3. Frost. Very low corn yields occur during years of early frost.

Why were yields of some crops less variable?

- **Sugarbeets:** High level of management. Excellent management can go a long way to overcoming production challenges. Sugarbeets have a large number of production challenges - diseases, weeds, insects, stand establishment. Sugarbeet producers overcome these challenges by scouting, timely application of inputs, crop rotation, and a host of other management methods. Sugarbeets also seem to tolerate excess water better than most other crops.

- **Soybeans:** Soybeans are a generally hardy crop with strong genetic characteristics for pest resistance. Soybeans also appeared to tolerate excess water better than most other crops.

- **Barley:** Barley is also a hardy crop. It has some tolerance to excess water, and it is less susceptible to scab than wheat.

Loss - Million $/Yr: The cost in the region of not getting the 'attainable yield' is about $204 Million/year. That is equivalent to over $65/A per year. With an additional $65/A per year we would have no 'ag crisis' in the region.

The message is clear. **Success is a search and destroy mission - searching out and destroying yield limiting factors.** Start with the biggest ones and move down the list. It isn't easy and it isn't glamorous, but it is the only way to profitably grow commodities in this part of the world.

Measured Soil Nitrates Higher Than Normal This Year

George Rehm, Extension Soil Scientist

This spring, several consultants have called and reported that the amount of nitrate-nitrogen (NO_3-N) measured to a depth of 2 feet is higher than normal. Some are seeking an explanation. Has there been a change in the analytical procedures that soil testing laboratories use to measure NO_3-N? Is this observation unique to this year? What does this mean for farmers who have not yet applied nitrogen and are waiting for a sidedress application?

Since the reports come from several areas of the state and various laboratories have analyzed the samples, laboratory error is not a concern. The analytical procedure used for measurement of NO_3-N has not changed. In addition, laboratories always include "check" samples in their operation. These "check" samples have known values. If the measured value for the "check" is not correct, samples are analyzed again. So, laboratory error can be discounted as a cause of the higher values.

The explanation probably lies with a serious consideration of weather conditions from last fall until now. Most samples collected for measurement of NO_3-N are taken in October and November. In typical years, cold temperatures in these two months stop mineralization (conversion of organic nitrogen to NO_3-N). Last fall, soils were warm into December. These warmer-than-normal temperatures probably accelerated mineralization thereby producing more NO_3-N.

This spring, of course, has been drier than normal. As a result, there has been no leaching and/or denitrification. So, there has been no loss of NO_3-N as might be experienced in more typical years. Therefore, if weather is considered, it is reasonable to expect an increase in measured NO_3-N.

This is positive news for farmers who have not yet applied any fertilizer N. Research has shown that recommendations for fertilizer N can be adjusted for the amount of NO_3-N measured to a depth of 2 feet. So, high amounts of NO_3-N this year translate to lower expenditures for fertilizer N. A soil test of NO_3-N taken now can be used to more accurately predict the amount of fertilizer N needed. Adjustments in recommendations for fertilizer N that are based on the measurement of soil NO_3-N are in an Extension publication entitled "Using the Soil Nitrate Test in Minnesota," available from the local County Extension Office.

Weed Control

Bruce Potter, Extension IPM Specialist, SW MN
Jeff Gonsolus, Extension Weed Scientist

There are many factors that should be considered when managing weeds. The following factors can influence when, where, and how to control weeds. This list is not written in stone and there are probably other, more effective, ways to view the universe.

Weed management-the basic rules

1) The crop needs nutrients, water, and light
2) Weeds compete with crops for nutrients, water and light.
3) Yield loss, caused by weeds, depends on which species are present, when the weeds are present, weed density and growing conditions
4) Weed species differ in how well they compete with crops and the germination and emergence of an individual species is based on soil temperature, soil moisture and light requirements.
5) Weeds can be controlled with tillage, herbicides, and the crop itself (crop canopy)
6) Economics dictate that weeds should be controlled when the cost of weed control is less than the cost in lost yield from weed competition. Unfortunately, biology dictates that weeds left uncontrolled produce seed for future weed problems.
7) Effective weed control requires matching the operation or herbicide to the weed species a field, crop and weed stage and growing conditions (yes, this applies to Roundup too).
8) Herbicides can cause crop injury and may carry over to injure the next crop.
9) Effective and economical weed management should be conducted on a field specific basis.
10) Weed control practices, or lack thereof, will change the weed species present in a field over time.

Weed management under dry conditions
Weed control under drought conditions is affected by the factors listed above.

Water is the most limiting factor in crop production under dry conditions. Weeds, being plants, require the same resources as the crop. Additionally, some species are more effective at obtaining these resources than the crop. Weeds are not good at sharing. This allows them to out-compete the crop and will eventually make light a limiting factor as weeds shade the crop. Therefore, the crop cannot tolerate weed pressure for as long a time period under dry conditions. Timely weed control is more critical under drought stress.

For most weed species, a moisture event is a requirement for germination. Therefore, compared to average, weed flushes may be delayed. In species where there is a maximum temperature for germination, there may be reduced total emergence for the season. In the case of delayed germination, weeds that would normally be controlled with pre-plant tillage will escape.

Several preemergence herbicides rely on rainfall for movement from the surface into the area where weed germination occurs. Rainfall of ½ to ¾ inch is generally considered adequate. Weed control by these herbicides will be poorer when spring rainfall does not occur within 7-days after application; the time when weeds generally begin to emerge. Preplant-incorporated herbicides will be less impacted by dry conditions because they are already incorporated into the weed emergence zone.

Rotary hoeing will provide weed control for early season weed escapes. Some stand loss

can occur with rotary hoeing but this is generally outweighed by reduced weed competition.

Cultivation of row planted corn and soybeans will also provide control of weed escapes. Shallow row cultivation (1-2 inches deep) will not drastically reduce soil moisture and may have a beneficial effect by mulching the soil surface and sealing cracks.

Post emerge herbicide treatments are affected by drought conditions. Weeds under moisture stress tend to have an increased wax layer on the surface, stomates are less open and weed respiration is reduced; in general, weeds are less actively growing. These factors reduce the effectiveness of herbicides. Adjustments of adjuvants may be required. Adjuvant recommendations are herbicide specific. Please refer to the label for details on adjuvant recommendations for a particular herbicide. Control of weeds at the large end of labeled size range, in particular, can be reduced. Crop growth, and weed control provided by the crop canopy, will be reduced under drought conditions. Split herbicide applications to control early and late emerging weeds while they are less than 2-3 inches tall can help.

Dry conditions the previous year can increase the chance for herbicide carryover, especially when a loose interpretation of the label was used. For example, several growers extended their tall waterhemp control well into late July of 1998. In 1999, these growers experienced some herbicide-induced crop injury to their corn from products not normally associated with carryover. In the heat of battle, the growers lost track of the potential consequences of late-season herbicide use. Most herbicides with residual activity rely on hydrolysis and microbial activity to break down. Both of these require water. Unfortunately, drought effects on the crop can mimic ALS and DNA herbicide injury making field diagnosis difficult. Symptoms of growth regulator and triazine carryover are easier to distinguish than those of ALS and DNA herbicides.

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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IN THIS ISSUE

Monitoring Drought

Mark Seeley, Extension Climatologist

Many agricultural areas from the southeastern states, west to the southern plains states and north to the Corn Belt and portions of the northern plains are reported to be experiencing moderate to severe drought. This encompasses parts of Minnesota, particularly the southwestern counties.

There are many dimensions to drought, and before the media get too carried away with drought stories this year it is important to distinguish some of the definitions. In the simplest form, **meteorological drought** is an accumulated precipitation deficit. The tolerable limit to this deficit varies by region and depends on what impacts it has. **Hydrological drought** is an extended interval of low stream flow, lake levels, and decline in ground water reservoirs. The trend toward hydrological drought is already in evidence in some parts of Minnesota, though the decade of the 1990s produced such prolonged moisture surplus that we grew accustomed to lake levels and stream flows that were generally higher than average. Current data show that the flow in many Minnesota watersheds is lower than normal for this time of year, with the exception of the Red River of the North. These low flows will be monitored by the USGS, the National Weather Service North-Central River Forecast Center, and the Army Corps of Engineers. For controlled watersheds like the Minnesota River and

Mississippi River, low flow monitoring will be used to evaluate how much water to release from reservoirs and lakes.

Agricultural drought represents an extended interval of serious soil moisture deficiency during critical crop growth stages. This type of drought may occur as a result of a rainfall deficient summer season, or as a carryover effect due to lack of fall and winter soil moisture recharge. The latter is the case for moderate to severe drought in southwestern Minnesota and much of Iowa and Nebraska this spring. It can be greatly exascerbated by warmer than normal temperatures which accelerate evapotranspiration, further imposing a heat stress on crops. Lastly, **socioeconomic drought** is the composite effect of water and soil moisture deficiencies on economic or seasonal activities such as the generation of hydroelectric power, labor requirements for seasonal food products and processing, and employment in the recreation and tourism areas.

Drought severity (degree of precipitation or soil moisture deficiency), duration and geographic extent are important characteristics when evaluating the potential implications of the current situation against those consequences of drought seen in past years. Though the lessons of the past suggest that spring drought conditions are often partially alleviated by growing season precipitation in most years, it is often the case that crops remain shallow rooted throughout the growing season as a result of the roots not being able to grow through a rather deep dry layer to reach the soil moisture at depth. If this is the case for some southwestern counties this year, timely rains will be needed to produce a crop that continues the upward yield trends seen in the 1990s.

An ongoing assessment of the drought across the United States can be found on the Minnesota Climate Group web site http://www.climate.umn.edu

Fungicide Seed Treatments for Soil and Seed borne Soybean Diseases

Bruce Potter, Extension IPM Specialist SW MN
Seth Naeve, Extension Soybean Specialist

Soybeans are susceptible to many species of fungi and bacteria in the seed and seedling stage. Seed rots, damping off and seedling blights of soybeans are generally worse under wet conditions. Poorly drained and compacted soils are especially prone to these diseases. Economic returns most often occur when soybeans are planted under cool, wet conditions. Very early planting, wet or poorly drained soils and minimal tillage are cases where a seed treatment is most likely to pay. The species of fungi responsible for disease in a soybean field depends on several factors: Species complex present, temperature and moisture conditions and the genetics of the soybean variety.

Soybean seed treatments can help protect soybean seed and seedlings from fungal attack early in the season. They do not, however, guarantee that you will not have stand loss from fungal pathogens later. Fungicides for seed treatment, although some are systemic, have a limited time period in which they are effective. This means that soybeans can be protected early in the season but succumb to root rots when conditions are favorable for infection later in the season. In the case of root rot caused by Phytopthora there is an additional option. Genetic resistance is available in the form of Rps genes and field tolerance. Genetic resistance, if matched to predominant races of the fungus in the field, or field tolerance will provide season long protection.

Fungicides are not effective against all species of fungi and bacterial pathogens are unaffected by fungicide treatments. Combinations of several damping off/root rot fungi can attack soybeans. This can also make it difficult to distinguish between primary and secondary invaders on soybean seedlings and roots. The fungicide must be

matched to the pathogen problem. For example, Metalaxyl and Mefanoxam provide excellent control of Pythium and early season Phytophthora but have little activity on other soybean damping off fungi. Fungicide combinations are used to broaden the species activity spectrum of treated seed. Some seed treatments must be commercially applied. An excellent chart on the effectiveness of seed treatment fungicides against several fungal species is available in Extension Bulletin 472, Soybean Production published by the Ohio State University. This bulletin is also available on-line at http://www.ag.ohio-state.edu/~online/b472/soy.html.

Disease pressure is not consistent from year to year. A fungicide seed treatment does not guarantee an economic benefit. For example, in 1999 studies conducted by Drs. S. Naeve and J. Kurle, the effect of broad spectrum seed treatments varied by location. At Lamberton and Morris a benefit from seed treatment was not observed. In the cooler soils of the Red River Valley locations, Crookston and Ada, yield increases were observed during 1999.

Finally, some fungicide seed treatments may have a detrimental effect on Rhizobia inoculants. Carboxin has a moderate effect on nodulation; Captan and PCNB fungicides can severely reduce nodulation. If using both a fungicide seed treatment and Rhizobia inoculant, apply the inoculant immediately before planting.

The attached table (electronic format) lists several species of fungi that can cause seed rots and damping off in Minnesota soybeans, their biology and control methods. A copy of this file can also be downloaded from the web at http://swroc.coafes.umn.edu/SWMNPEST/diseases/beandiseases.htm.

Crop Selection 2000: Some Final Notes on Economics Before Hitting the Fields

Zachary Fore, Extension Cropping Systems Specialist

Crop selection should be based on a combination of economics and agronomics. The economics: Farmers need profitability. The agronomics: Farmers want crops that compliment each other in a rotational system and they want to minimize production risk. Dr. Michael Peel, NDSU Small Grains Extension Agronomist, has done an excellent job of presenting the agronomics of crop rotations in NDSU Extension Bulletin EB 48 'Crop Rotations for Increased Productivity'. The bulletin is available on the web at http://www.ext.nodak.edu/extpubs/plantsci/crops/eb48-1.htm.

The economics of crop selection have been problematic in recent years, to say the least. See Table 1 below: Northeast ND 2000 projected crop budgets. The numbers in Table 1 are based on average yields for the eight-year period from 1991-1998 with the low and high yield years removed. The prices are best estimates, using the loan rate as a floor. Costs are average actual costs in the area. Government payments are not added in since they are decoupled from production. The numbers are also representative for Northwest Minnesota.

Table 1: Northeast North Dakota 2000 Projected Crop Budgets

Crop	Yield/A	Price/ Unit	Gross Return/A	Costs/A	Net Return/A
Spring Wheat	29	3.13	91	114	-23
Durum Wheat	26	3.33	87	114	-27
Barley - Malt	51	2.13	109	113	-5
Corn	67	1.70	114	167	-53
Sunflowers - Oil	1260	0.092	116	127	-11
Sunflowers - Conf	1260	0.13	164	139	25
Soybeans	23	4.72	109	126	-17
Dry Beans	1260	0.15	189	172	17
Oats	57	1.03	59	102	-43
Flax	20	5.26	105	104	1
Canola	1350	0.097	131	135	-4
Yellow Mustard	1000	0.106	106	93	13
Field Peas	36	3.24	117	126	-9
Crambe	1300	0.078	101	103	-2
Millet	1600	0.045	72	88	-16
Buckwheat	950	0.104	99	92	7
Alfalfa - Established	2.0	50	100	96	4

These are average numbers for the area, and it is likely that the numbers for every individual producer will differ to some extent. However, what these numbers tell us is this: Without AMTA and other government payments, on the average farmers are losing money on most crops. Of the 17 crops listed, 11 crops give a negative net return averaging -$19/A, and 6 crops give a positive net return averaging $6/A.

So, what should a producer do? Grow just those 6 crops that give a positive net return? Most producers would not be equipped to grow all these crops, and they may not fit in their rotational system. Market and production risk may be high on some of these crops, as well. And even the profitable crops only average a positive net return of $6/A.

To be profitable growing the crops in Table 1, producers have to do one or more of the following:

- Get higher yields
- Get higher prices through improved marketing
- Have lower costs

I have studied many years of data which indicate that for most producers, the biggest opportunity by far is to get higher yields. A distant second is to get higher prices through improved marketing, and last is to reduce costs. Obviously, improving all three will give producers the best chance of profitability, but it makes sense to put the most effort where the potential benefits are highest.

There are two additional ways to improve profitability other than the three I just mentioned:

- Get higher prices through adding value
- Grow higher value crops than those listed in Table 1

Producers can add value to a crop by producing it for a specific use or with specific traits. Examples include producing a crop for seed, high oil or with specific oil quality, or for human consumption.

Usually this will require identity preservation and/or certification.

Growing higher value crops may be the most financially attractive option of all. However, it is a difficult option because producers will have to identify a market and buyer, and learn to produce the crop.

The bottom line: Improve yields, improve marketing, and manage expenses. And keep in mind that future profits are increasingly going to come from adding value to what is produce, and producing and marketing crops in different ways than in the past.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

1999 Red River Valley Corn Survey

The diverse and frugal management strategies revealed by the 1999 corn survey, showed corn farmers in the Red River Valley region are savvy to corn production and pest control. The survey, run through funding provided by the North Dakota Corn Growers and the State Board of Agricultural Research and Education (SBARE) as well as through the North Dakota Experiment Station and Extension Service, pinpointed that information to growers is key to optimizing farming operations. Farmers continue to want production information, then marketing techniques, more facts on value-added uses of corn and updates on legislative issues and information.

Most corn growers in the north-central region like to get into corn fields within the last week of April and the first week of May but finish planting on the average around May 20 to May 30. Over 82%, plant corn in 30" rows. Although wet soil limited many (68%) in 1999, other problems cited included wind, weeds, stalk rot, corn borer, lack of heat units and hail as common problems for the area.

Conventional tillage or operations requiring two or more tillage passes is still common for 56% of the farmers. Most plant at 25,000 to 27,999 (39%) but the general seeding population is moving up with the new hybrids and 12% of the farmers now plant at 30,000 to 32,499 seed per acre. Most hybrids are chosen based on yield but tempered with stalk strength and quick drydown. Crop price continues to influence the decision to grow corn. Soil testing to determine fertility needs is common practice with most farmers at least putting on preplant applications and often another application whether earlier in the fall or later in the early season.

Pest concerns vary but 26% of the farmers still need some stalk rot protection. European corn borer is commonly identified in fields along with wireworms, rootworms and cutworms. University or Extension information is a major conduit of information to area farmers followed by the increasing education and experience of area growers and supplemented with information from salesmen, private consultants, news articles, other farmers and the Internet.

The key weed targeted by corn farmers is foxtail (25% reported a problem) followed by Canada thistle, wild proso millet, black nightshade, kochia, common cocklebur and quackgrass. 14% of the corn farmers reported resistant weed problems, mainly with kochia. The most popular corn herbicides in 1999 were Accent (50% of the respondents to the survey question tagged this chemical) followed by Banvel or Clarity (47%), Atrazine (41%), DoublePlay (31%), Distinct (24%) and Surpass (24%). Few farmers feel that any herbicide does a perfect job in the corn fields, but the favorites for cleaning up weeds according to survey respondents were DoublePlay (12%), Surpass (8%), Accent (6%) and Celebrity or Distinct (5%). Herbicide injury was reported from 1999 with only 5% having some trouble with Distinct and 4% mentioning Accent.

Most corn farmers in the region plant three to four different crops with the most common combination across the farm being corn-soybeans-wheat. Around 64% tried using Bt corn or some other genetically-modified (like Roundup-Ready or Liberty-Linked) corn last year and 64% stated that they would plant some GMO crops again this year. With limited maturity ranges for the GMOs and in winter costs being higher on the seed, acreage was originally expected to stay about the same. Corn acreage averages just a little above 1999 for expectations in 2000 from the corn survey respondents.

Casing the Causes Controls the Culprits

It is not an easy case to crack, but the third tenet of integrated pest management (IPM) is to determine the cause of any pest troubles in order to correct field problems. Conditions that allow the pest to proliferate must be identified and modified at the same time you concentrate on direct control of the pest. Correcting the cause of a pest problem, such as poor drainage in portions of the field that activate the growth of water-loving weeds, requires that the farm manager understand the biology and the ecology of the plants so that the crop environment can be manipulated to the advantage of the crop and to the disadvantage of the weed. Understanding cause and effect of any manipulations or controls used as well as any other potential pests problems that might arise from changes made is important. In weed management strategies, this IPM tenet can be simply stated as using an integration of techniques to anticipate and manage problems rather than simply reacting to them after they are present. Indeed, prevention of weed problems requires long-term management strategies and continual assessments of crop and pest field conditions throughout the season as well as over years.

My Lambsquarters may Compete Less than your Lambsquarters

The weed characteristics or mechanisms that really cause weed interference with crop yield are difficult to determine much less quantify. However, recent studies looked at how common lambsquarters create economic risk in crops. Experiments were established to look at weed leaf area development, photosynthetic capacity, height and seed yield in crop field conditions as well as under solid weed infestations. Between years and even between different environments in which the trials were run, weed phenology (general appearance) varied. Weed leaf area was greater under corn crop conditions in 1998 but decreased in 1999 as weed density increased within corn cropping systems even more than under monocultures of just common lambsquarters. Economic thresholds on weeds may be difficult to establish precisely due to the multitude of interacting factors on the crop and even due to appearance and characteristic variability of the same species of weeds across geographic regions and environments

The Beauty of this Weed Takes my Headache Away

A perennial that is native to the United States is the forb known as the wild violet. Also called the wild pansy or prairie blueviolet, this weed flowers from March to June but occasionally can be seen with inflorescences throughout cooler summers. It reproduces by seed and, depending on nutrient and water supplies, the plant can stand from two to twelve inches tall. The single flowers grow from the leaf axils of the weed and extend beyond the plant's leaves. Dark violet, violet, blue or even more rarely white, the flowers will produce several seeds. The fibrous root, or under more rocky or tighter soil conditions, the taproot of the weed is fairly shallow. Found on prairie ground, roadsides, pastures, lawns and even kept in flower beds, the wild violet is nearly impossible to separate from other violets. The dozen different wild species or so have hybridized with several of the garden-variety violets. The highly variable shaped leaves of this weed can be eaten as greens and early pioneers made jellies and herbal vinegar from the flowers. Folk medicine suggests a tea be made from the flowers to treat headaches and sore throats. In fact, the flowers do contain salicylic acid.

Watch the Broadleaves and Grasses in Corn

Corn yield and effects of weed pressure on the crop have always been difficult to identify and characterize. Unfortunately interacting factors such as early season temperature, soil conditions and

moisture availability limit the scope of understanding the complex problems from weed competition in corn. A series of experiments have been started in Wisconsin to closely examine common lambsquarters and giant foxtail competition in corn. Like the soybean studies initiated on the same weeds, these trials found that weed densities and proportions of both weeds within a field do make a difference in corn yield but may not provide a direct correlation. Competitive ability of giant foxtail was greater than common lambsquarters in 1998 but in 1999 lambsquarters were more competitive. Variability in the final crop yield loss between the two years was likely due to differences seen in common lambsquarters emergence timing (similar to giant foxtail in 1998 but three days earlier in 1999). Yield loss was greatest in corn in 1999 when the common lambsquarters had the upper hand through earlier emergence for stronger competition in field conditions. Unlike the studies done with soybeans, corn yield losses could not be adequately described simply by variability in relative weed competition or the crop yield loss by species using weed volume or weed leaf area across the trials. Early competition by weeds can severely affect final corn yield. The earliest emerging weeds take advantage of their early foothold to out compete both corn and later weeds unless strict management is applied to give corn the competitive advantage.

Watch that Grass Control in Soybeans

Environmental variability between seasons and changes in soybean varieties over time limit the true understanding between weed competition effects and crop yield loss. Research in 1998 and 1999 was run in Wisconsin to look at common lambsquarters and giant foxtail competition in soybeans. In 1998, giant foxtail was more competitive than common lambsquarters and soybean yield loss could be predicted based on weed density and even weed relative leaf area during soybean growth stages of the second trifoliate, fourth trifoliate and even during soybean flowering. Even at very low weed densities, soybean yield loss associated with giant foxtail was 11% while that with common lambsquarters was only 1% in 1998. At high weed densities (64 weeds per approximately 11 square feet), soybean yield loss under heavy giant foxtail pressure was 95% and yield loss under heavy common lambsquarters was 50%. If heavy grass weed competition is predicted in certain fields, consider preplant or early post grass control herbicides.

Plant Disease Clinic

Sandra Gould, Assistant Scientist/Plant Pathology

Samples submitted to the Plant Disease Clinic in March and early April included:
corn, wheat & soybean--cultured for storage molds
barley--tested for loose smut
silage--cultured for storage molds
tomato--bacterial leaf spot
Dahlia--Dahlia mosaic virus
Lamium--*Phytophthora* sp stem rot
geranium--*Pythium* sp root rot, *Xanthomonas campestris* (bacterial wilt), rust
Impatiens--*Pythium* sp root rot, *Myrothecium* sp leaf spot & INSV
stock--*Pythium* sp root rot
snapdragon--*Pythium* sp root rot
Viola--*Pythium* sp & *Thielaviopsis* sp root and stem rot
Gardenia--*Phytophthora* sp root & stem rot
daylily--*Collecephalus* sp (leaf streak), *Phyllosticta* sp leaf spot
daisy--bacterial leaf spot
lupine--*Colletotrichum* sp stem rot
coleus, Aegopodium, Temari & Artemisia--INSV (Impatiens necrotic spot virus)

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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IN THIS ISSUE

Check Your Planting Rates

Joseph Schafer, Polk County Extension Educator

Proper crop seeding rates are an important part of attaining maximum yields. Some crops have a limited ability to adapt to low seeding rates, but most will generally yield better when seeded at highest optimum rates. You can use bin-run seed for soybeans and grains, but check the germination rate, and adjust the planting rate to compensate for low germ. You should also increase seeding rate for expected stand loss.

Seeding rates may be referred to by either seeds/acre, or pounds/acre. Here is a general formula for calculating seeding rates:

Seed Rate (lbs/acre) = (desired stand count) x (1+ expected stand loss) (seeds/pound) x (% germination)

Here is an example for small grains:

Desired stand 1.25 mill.; 20% (.20) expected stand loss; 13,000 seeds/pound; 92% germ = 125 lbs/acre.

Seed size of many small grain and soybean varieties will vary, so you should check the seeds/pound and plant for a desired stand count, not just planting bushels or pounds per acre. Normal stand losses range from 10-20%, but can be higher in poor seedbed conditions.

Some common crops in northwest Minnesota are (Including 10% stand loss adjustment):

Spring Wheat - population 1.25 million plants/acre; or 28-30 plants/sq ft. Seeding rate w/95% germ = 1.45 million seeds/acre

Barley -population 1.20 million plants/acre; or 28 plants/sq. ft. Seeding rate with 95% germ = 1.39 million seeds/acre.

Corn - population 25,000 to 32,000 plants/acre

Seeding rate with 95% germ = 28,9000 to 37,000 seeds/acre.

Soybeans - population 160,000 to 220,000 plants/acre. Seeding rate with 95% germ = 185,200 to 254,700 seeds/acre.

Some growers have experimented with rates up to 400,000 seeds/acre, in combination with mechanical weed control which reduces stand. Soybeans planted in rows (at same rate) are able to penetrate crusted soil better than solid seeded, and may show less chlorosis.

Sunflower - population, Oil type 21,000 plants/acre. Confection type 16,000 plants/acre. Seeding rate with 95% germ = 24,300; and 18,500.

Low planting rates will affect your harvest yield because of competition from weeds, less than optimum heads or pods per acre, and poor utilization of nutrients and chemicals. Check the germination percent of your seed, estimate stand loss, and calibrate your planting equipment to make sure you are seeding the amount of seed you want. Call your County Extension Office for more information on seeding rates, dates, depths, fertility, and variety information.

Soybean Variety Selection for Environmental and Chemical Interactions

Ken Pazdernik, Norman County Extension Educator

Chlorosis Country" an article in the March 2000 Minnesota Farmer magazine hit my eye. Iron chlorosis clipped soybean yields. A number of University researchers from North Dakota, South Dakota and Minnesota along with private companies representatives responded to the iron chlorosis problem.

I'll try to summarize our soybean variety selection process. If you have had iron chlorosis in the past, you will have it in the future, unless you change a few items in your operation.

Dave Franzen, NDSU Extension Soils Scientist believe it's in the soil. High soluble salts above .4 to .6 mmohs/cm on sandy soils and .6 to 1.0 mmohs/cm on heavy soils, then plant highly tolerant varieties. The researcher found that the safest herbicides to use are Galaxy, Basagran and Flexstar on those soybeans showing iron chlorosis stress. If your fields are over 1.0 mmohs/cm soluble salts, plant highly tolerant varieties and don't plant soybeans on 1.5 mmohs./cm fields.
In a 1999 NDSU trial, systemic and contact herbicides clipped yields of iron chlorosis - stressed soybeans by 9 to 19 bushels per acre. Raptor and Cobra zapped yields the most.

George Rehm, University of Minnesota Extension Soils Scientist says "Anything that stresses a plant can accentuate iron chlorosis". He indicates high pH soils ranging between 7.3 to 8.4 pH will stress the plant making the plant more susceptible to iron chlorosis. He also mentions certain herbicides also may strain soybeans prone to iron chlorosis.

Jim Gerwing, South Dakota State University Extension Soils Scientist says "In severe cases, yields went down to literally nothing", yield losses were hinged to iron chlorosis severity.

Soybean iron chlorosis or induced yellowing and stunting of soybean plants are the end results of environmental and chemical interactions.

A check list to go by:

1. Check the iron chlorosis tolerance of a variety, watch the ratings between university (1-5 ratings) and some private companies(1-9 ratings).

2. Check the soils for soluble salts, use parameters listed above from NDSU Dave Franzen for soil types.

3. Check the soil pH, any soil above 8.4 it's not good, sodium salts are accumulating, needs more inner soil drainage and lower water table.

4. Check soybean growth before applying herbicides, go to third tri-foliate or reduce rates if applied earlier, additives makes chemicals more active.

5. Check humidity and temperature, high humidity more active the chemicals, low temperatures slows down plant metabolizing the chemicals.

6. Check variety for Phytophthora Root Rot (PRR) tolerance, roots are the major factor in good healthy plant growth.

7. Soil moisture and soil air are in relationship to good plant health, high soil moisture induces iron chlorosis, so cultivate or rotary hoe to aerate the soil.

Update of Potassium Soil Test Levels in Southeast Minnesota

Tim Wagar, Extension Education - Crops and Soils
Roger Eliason, Director, U of M Research and Soil Test Laboratory

Corn producers in southeast Minnesota have the potential to improve yields with nominal rates of potash fertilizer. Nitrogen is the most important fertilizer input for corn production and is especially the case if operating funds are tight. However, in southeast Minnesota even if sufficient amounts of nitrogen are available for the crop, fields that have low potassium (K) soil tests of 80 ppm or less could result in lower than optimum yields.

Often times the symptoms of K deficiency in corn is mistaken for nitrogen deficiency or herbicide damage. Affected areas in fields have uneven growth patterns and the plants are stunted, yellowish green, and the leaf margins of the lower leaves have a scorched appearance. Low K soil test levels are primarily due to the large amounts of K that are removed at harvest, specifically with corn silage, alfalfa haylage, and alfalfa hay. In addition, the availability of K for plant uptake is reduced because of a type of clay found in the silt loam soils that are predominant in the area. These soils can readily fix K, which becomes slowly available for crop uptake. Other factors that may affect K uptake by corn are soil moisture, compaction, and reduced tillage.

In a previous Crop News article, it was reported that 29% of the soil samples from southeast Minnesota that were submitted to the U of M Soil Testing Laboratory during 1990-1997 had low K soil tests. A recent laboratory summary of soil test results from 1998 & 1999 showed 28% of the soil samples received were at low K levels. These low K soil tests should be a concern to farmers growing corn in the region. Field trials conducted the past few years have shown significant yield increases for corn when recommended potash rates were applied with starter or broadcast fertilizer on low K testing soils.

Soil Water And Crop Water Use

George Rehm, Extension Soil Scientist

Soil moisture is a concern in much of Minnesota as we head into the spring planting season. So, this might be a good time to review some basic concepts about soil moisture and crop water use.

The amount of water in soils that can be used for crop growth is usually referred to as, available water. This amount of water is not the same for all soils. It is strongly affected by soil texture and to some extent by soil structure. Available water is the amount held between two limits: field capacity (upper limit) and permanent wilting point (lower limit).

When water from rainfall or snow melt is added to a soil surface, some is held against the force of gravity and some drains through. The moisture content when drainage of free water stops is referred to as the field capacity. The moisture content at which plants wilt and die is referred to as the permanent wilting point. The available water is approximately 50% of the difference between field capacity and permanent wilting point.

Available water is usually reported as inches of water per foot of soil. The relationship between available water and soil texture is summarized in Table 1.

Table 1. Relationship between available water and soil texture.

Soil Texture	Available Water	
	Range	Typical
	- - - in./ft. - - - -	
coarse sand and gravel	0.3 - 0.6	0.5
sand	0.5 - 0.8	0.6
fine sand	0.7 - 1.1	1.0
loamy fine sand	0.9 - 1.3	1.2
fine sandy loam	1.1 - 1.9	1.6
loam	1.2 - 2.3	1.8
silt loam	1.4 - 2.6	2.0
silty clay loam	1.5 - 2.5	2.2
clay loam	1.4 - 2.4	2.0
clay	1.6 - 2.2	1.8

Source: University of Nebraska

Although my sampling has not been extensive, there haven't been any fields in southern Minnesota where soils are at field capacity to a depth of 5 feet. Specific soil moisture information can be obtained from the Research and Outreach Centers at Morris, Lamberton, and Waseca.

When thinking about soil moisture, it's important to remember that calculation of available water must take rooting depth into consideration. The effective root zone may not be more than3 feet until plants reach a height of 3 feet. Roots go deeper as plant height increases.

If a soil with a silty clay loam texture was saturated to a depth of 5 feet, there would be approximately 11 inches of water available for crop use. Using the information provided in Table 1, it's possible to calculate available moisture at various root depths for other soil textures. At this time, many fields in Minnesota have less than this amount available for crop use.

Water use by an actively growing corn or soybean crop is more than the amount of water held by soils at field capacity. The difference between the amount needed and the amount available in the soil must come from rainfall and/or irrigation. Looking ahead, it's obvious that considerable rainfall will be needed during the 2000 growing season to produce good yields. Therefore, it would be wise to make every effort to conserve as much soil moisture as possible.

Crop Water Use

Jerry Wright, Extension Engineer
West-Central Research and Outreach Center, Morris

Water is a most important component of crop production. Over the growing season an annual crop may require 15 to 20 inches of soil water to enable healthy plant growth and nutrient uptake. This soil water amount needs to come from in-season rainfall and pre-season stored soil water in the rooting zone.

Daily crop water usage (also known as evapotranspiration or ET) is very dependent on the stage of plant growth, soil water status and the day's weather, especially air temperature and solar radiation (sun energy). Daily ET will very from less than 0.05 inches to over 0.30" depending on the plant size, canopy cover and the weather.

Evapotranspiration (ET) is the combination of water

that is evaporated from the soil surface and the leaf area by transpiration. When plants are small much of a crop's daily ET (0.05 to .10 inch per day) comes from soil surface evaporation. As the crop canopy cover increases the daily crop ET increases to typically 0.15 to 0.30 inches per day during full canopy and good soil moisture conditions. The ET during this time period comes mostly from transpiration from the plant leaves. If the soil moisture content in the active root zone is less than 50 percent of capacity, the daily ET of a crop can be significantly reduced during these times. This will cause some degree of stress to plant growth and yield reduction depending on the length of time this soil moisture shortage occurs and the weather conditions at the time. Daily crop water usage (ET) estimations for full canopy crops across Minnesota can be observed on the internet at http://bob.soils.wisc.edu/wimnext/water.html

The following table gives some average responses of crop yield per inch of water use (ET), total ET under optimum growing conditions and the minimum ET required for minimum growth but no yield. The average irrigation amounts are based on sandy loam soils located around Staples, MN.

Yield response per inch of crop water use (ET)

	Crop Yield per Inch - ET	Total ET Opt. Yield Inches	ET Min. Yield Inches	Reference	Average Irrigation Inches
Alfalfa	0.2 - 0.3 tons	20-25	–	1,3,6	13+
Corn Grain	8-15 bus.	16-20	8	1,4,6	10+
Soybeans	2-6 bus.	14-18	5	2	9
Wheat	3-5 bus.	14-16	6	1	7
Dry Beans	150-300 lbs.	10-17	4	1,5,6	7+
Potatoes	22-29 CWT	16-20	4	1,4	13+
Sugarbeets	1.5 tons	18-20	8	1	-

References: (1) Lundstrom, 1986. NDSU - Extension "Water Spouts" (2) Stegman, 1988. ASAE paper 88-2099, ND #86, (3) Sharratt, et al. 1987. MAES, UM Station Bulletin 581 (4) Werner, 1984. PhD Thesis. UM, St.Paul, (5) Oakes, North Dakota Irrigated Crop Production Trials 1983-1990. (6) Staples Irrigation Farm

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Irrigation and Corn Growth Stages

With weather conditions unpredictable for spring, irrigation scheduling in corn should be carefully considered. Based on weather (useful rainfall), soil moisture availability and moisture needs for corn at critical growth stages, irrigation scheduling can go without a hitch to maximize corn yield. In other words, manage scheduled irrigation based on either soil water need or crop water use along with optimization of pumping plant efficiency and strong, high-yielding hybrid choices. Plant corn tolerant to your environmental conditions and to your irrigation system scheduling.

Timing is key when water use is to be optimized and seed-producing crops like corn, beans, wheat, barley and sunflowers can rapidly respond to irrigation at particular stages of development. These grain and oilseed crops are usually more sensitive to stress during heading, flowering and pollination as compared to other

crops such as sugarbeets, potatoes and alfalfa that respond more directly to heat and cumulative water use than to stress at specific growth stages.

Corn is very sensitive to drought stress during the flowering and reproductive stages. Early vegetative stages having stress are not nearly as serious as stress during flowering, pollination and early seed filling (http://www.montana.edu/wwwpb/ag/irrigate.html) . Grain corn is the most sensitive to drought stress between the twelfth-leaf and blister kernel stages. Corn can be irrigated during these stages without any harm to pollination (overhead irrigation is over too short a period to hurt pollination and corn produces three to five million pollen grains per plant which can fertilize 600 to 700 kernels per ear with pollen shed lasting ten to fourteen days). However, stress during any part of the cropping season can limit corn yield. If maximization of water use efficiency is important due to pumping costs, limit irrigations during the vegetative stages (before the twelfth-leaf stage), as this period from emergence to the twelfth-leaf stage in corn is the least sensitive to stress.

Remember that corn must be emerged and growing to utilize energy from photosynthesis and to have transpiration operating in the plants (the energy and cooling processes in corn) in order to better tolerate stresses during crop growth. Therefore, if moisture availability in the upper six inches of the soil profile is limited before planting, consider a preplant irrigation in order to get the corn seed germinated, up and growing. Research run in 1980 (Musick and Dusek, ASAE 23:92-98, 103) confirmed that just under 12 inches of water is required to optimize corn germination in a clay loam soil (about the maximum amount of plant available water that can be stored in this low, organic matter soil). Good stand counts in corn will optimize the potential for final yield. With irrigations critically timed to prevent mid-season stresses during flowering and reproductive stages in corn, seeding rates of 32,500 or just above with the short-season corn grown in North Dakota (within the suggested maturity ranges for your area) will allow a good stand to emerge and allow some mortality that might occur from pests or other problems in the field. Taper the seeding rate down, if irrigation will be limited. Also, remember that irrigation should be continued long enough to supply plant needs until physiological maturity (black layer) is reached. Too early a termination of irrigation, particularly during corn dent stage, can limit yield. Research has shown that termination of irrigation at the dent stage can reduce grain yield by 1.2 percent per day if drought stress is present (http://www.ext.msstate.edu/anr/plantsoil/grains/grain crops/corn2.html) . Low grain yield from corn can also be influenced by limited water extraction from the lower soil profile. The majority of roots throughout the season of the corn plant are located in the upper three feet of the soil profile, soil types that do not maintain good moisture further down in the soil profile may limit water availability to expanding roots and thus contribute to lower leaf area and consequently, lower grain yield. Different soil types may require different water management strategies to optimize water use. Fortunately, short-season corn grown in North Dakota and northwest Minnesota has an advantage of a reduced water requirement as compared to longer season hybrids grown further south (Howell, Tolk, Schneider and Evett, 1998, Agron. J. 90:3-9).

Weeds Have the Advantage when It comes to Numbers

Many times there is more information and understanding of insect pest life cycles than of most weed life cycles. And, the numbers tell all, weeds are prolific seed producers and can remain viable for a long time in the soil.

Yellow nutsedge	2,400 seeds per plant
Barnyardgrass	7,000 seeds per plant
Giant foxtail	10,000 seeds per plant
Velvetleaf	17,000 seeds per plant
Common lambsquarters	72,000 seeds per plant
Redroot pigweed	117,000 seeds per plant
Black nightshade	178,000 seeds per plant

(Adapted from Ross and Lembi, 1985, Applied Weed Science.)

Keep ahead of the pest problems this year. First, proper weed identification is essential for control. Correct weed identification is critical to determining strategy for weed management. Second, crop scouting and weed mapping take time, but provide information on crop condition and pest distribution. Third, the identification and mapping can allow you to predict future weed pressure.

Quackgrass	seeds last 6 years buried in soil
Shattercane	seeds last 10 years buried in soil
Giant foxtail	seeds last 20 years buried in soil
Canada thistle	seeds last 21 years buried in soil
Velvetleaf	seeds last 40 years buried in soil

Common lambsquarters	seeds last 40 years buried in soil
Redroot pigweed	seeds last 40 years buried in soil

(Adapted from Ross and Lembi, 1985, Applied Weed Science.)

Fourth, knowledge of the life cycle, plant characteristics, location where the plant thrives and why as well as how the potential population might be promoted within the life cycle for each weed species all tie together to help plan pest management. Get a game plan this year to stake out wily weeds and wrestle them to controllable numbers.

Part of the Principle is Not to Pander to Pests but to Economically Pursue

Integrated pest management (IPM) protects crops from pests that, if sufficient numbers exist, will cause economic damage. The second tenet of IPM is tolerance-the eradication of a pest is seldom necessary or desirable. The goal of winning with IPM according to this principle is to keep pest populations below economic damage levels, but allow a certain degree of pest infestation. Crops can tolerate certain levels of pest problems without adverse, economic effects. Decreasing pest levels below the economic level decreases profits with the increased input costs. Rarely does any specific control or IPM technique totally eliminate a pest. Pursuing total eradication of pests such as weeds defies economic sense. Pursue long-term management of pests, but keep your priorities on economic returns.

Notch in the Date for Best Corn Planting

Concerned about the response of corn to planting date, researchers in Wisconsin have shown that the optimum planting date for corn in the Northern Corn Belt remains around May 1 to May 7 in southern latitudes of the state and around May 8 to May 14 in the northern part of the state. However, the optimum was still at 95% in the north during May 15 to May 23 before shifts from full-season hybrids to mid- or short-season corn was important. Early corn planting at these dates allow hybrids to utilize the entire growing season, achieve maturity before the fall killing frost and even start to dry, reducing drying costs. Hybrid maturity tested were 80 to 115 day corn. Yield of the hybrids planted after May 8 in the northern region declined at the rate of 0.2 to 1.7% per day over the next two weeks and then accelerated in yield loss to 1.7 to 2.2% per day and even to 3.2 to 3.8% per day in week 3 and 4 after May 8. Like Wisconsin, optimum dates of planting corn here in North Dakota and northwest Minnesota have remained right around the first three weeks of May. Decisions to plant corn should ultimately consider soil temperature and field conditions as well as suggested calendar dates.

Gene Genesis may Eliminate the European Corn Borer

Knowing the genetic background of your corn hybrid may hold a secret promise of extra insect control. The ARS Corn Insects and Crop Genetics research unit in Iowa has been examining corn inbreds for natural tolerances to the European corn borer (ECB). The ECB annually causes $350 million losses to the nation's corn crop and without present preventions could cause losses exceeding $1 billion. The Ames research team identified two corn strains, B-96, that originated from Argentina, and Illinois A (ILLA) that have chemical defenses to ECB. B-96 contains HMBOA, a compound in the same chemical family as DIMBOA, found to protect young corn plants from feeding borer larvae. The B-96 inbred, unlike other corn, continues to produce high levels of DIMBOA and HMBOA as it matures giving it a chemical makeup that causes female ECB moths to reject these corn plants for others during egg laying. The Illinois A (ILLA) inbred line may even offer better resistance to egg laying if early test results are proof.

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CROP NEWS

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In This Issue

Comparing Liquid Starters

George Rehm, Extension Soil Scientist

With an eye on production costs, there seems to be a renewed interest in use of starter fertilizers for corn production. Fluid fertilizers are a popular choice for starter fertilizers. There are differences in the fluid materials that can be used for this purpose. Some fluids (9-18-9 and related analyses) are produced from food-grade phosphoric acid. The other fluids (7-21-7, 10-34-0, etc.), use concentrated super phosphoric acid in the manufacturing process. Differences between these two groups of fluid starters will be described and evaluated in the paragraphs that follow.

Price: Although there may be exceptions, the 9-18-9 and related fertilizers are made from the food-grade phosphoric acid. This acid is more expensive than the acid used to manufacture 7-21-7, for example. Thus, the cost of the end product is higher. If the more expensive materials produce higher yields, the added cost can be justified. If not, there is no agronomic or logical reason to purchase the higher priced material.

The 9-18-9 materials has been compared to a 7-21-7 fertilizer in various trials throughout the Corn Belt. The yield and phosphorus uptake data in the following table are typical of the results measured. This three-year average showed that both fertilizers had an equal effect on yield and phosphorus uptake when applied at the same rate.

Comparison of fluid fertilizers for corn production

Material	Rate of Application	Yield*	Phosphorus Uptake
	gal./acre	bu./acre	mg/plant
control	0	146	10.3
9-18-9	5	147	13.5
7-21-7	5	146	13.6

* Average of three years of data

Corrosion: There may be less corrosion of planting equipment with the 9-18-9 materials. The K is supplied by potassium hydroxide instead of potassium chloride and, therefore, less corrosion would be expected.

Availability of Phosphorus:
The phosphorus in the 9-18-9 and related materials exists in the orthophosphate form. The phosphorus in 7-21-7, 10-34-0, and most other liquids exists in both the polyphosphate (60 to 70%) and orthophosphate forms. There are claims that the P in the 9-18-9 fertilizer is more effective than the P in 7-21-7 and 10-34-0. These claims, however, are not supported by the facts.

In soils, polyphosphate is converted to orthophosphate within 7 to 10 days of application. So, if applied at planting, the polyphosphate will be converted to orthophosphate before corn emergence. Therefore, there is no difference in the agronomic effectiveness of the phosphate in all liquids.

Nitrogen Could Be A Problem:
The nitrogen in most products with a 9-18-9 or similar analysis is supplied from urea. Urea applied with the seed can damage emergence and cause a reduction in yield (see the following table).

Effect of rate and placement of N as urea at planting on corn yield.

Placement	N Rate	Corn Yield
	lb./acre	bu./acre
none	-	152.5
2 x 2	7.5	165.7
with seed	7.5	132.4
2 x 2	15.0	152.5
with seed	15.0	84.0

These data show that there is a risk of yield loss when urea is applied in contact with the seed. This is especially true when the seedbed is dry at planting. There have been grower experiences where 9-18-9 applied with the seed has reduced emergence and decreased grain yield.

Soil Moisture And Spring Planting

George Rehm, Extension Soil Scientist

Below normal precipitation for the past several months and predictions for a dry summer are adding up to a major concern for crop producers in much of Minnesota. Soil moisture levels are below normal in many areas. There's an old saying that we can stop a drought by writing and talking about it. So, perhaps, it's time to summarize some management practices that can be used to conserve soil moisture.

Keep Tillage To A Minimum: Each tillage pass across a field produces a loss of some soil moisture. Estimates of the loss vary. However, a loss of 0.25 inches of available moisture for each tillage operation is a number that is frequently used. If below normal precipitation persists, it will be important to keep the number of tillage trips across a field to a minimum.

No-till, ridge-till, and strip-till planting systems conserve soil moisture because of the residue on the soil surface. Growers who had thought about using one of

these systems should probably continue with those plans. Conservation of soil moisture has always been one of the major benefits of these tillage systems. This moisture savings could be very important in 2000.

Those who used a major tillage operation as part of a conventional tillage system last fall should plan to keep secondary tillage operations to a minimum. A light pass with a field cultivator may be all that is needed to prepare a good seedbed.

Be Careful With Seed-Placed Fertilizer: The application of fertilizer, especially fluids, with the seed has become a popular practice in Minnesota. In typical years with high soil moisture, this is a good practice when reasonable rates are used. However, the potential for damage increases as the soil around the seed dries out. If the seedbed is dry, reduce rates to no more than 4 or 5 gallons per acre. Plan on broadcasting phosphate and potash if the reduced rate will not provide the amount of phosphate and potash needed.

Take A Close Look At Your Yield Goal: Crop yields were very good in 1998 and 1999. Prospects for dry weather may dim some optimism. A realistic look at yield potential is important. For those who have not completed fertilizer application, amount of fertilizer used should be reduced if yield projections are lowered.

Keep Cultivation To A Minimum: Cultivation can result in the loss of some soil moisture. Therefore, the use of the cultivator and/or rotary hoe should be avoided if dry weather persists. There are several herbicides that will provide for adequate weed control. If herbicides are working, avoid cultivation.

Fuel Saving Ideas for Farmers

Bill Wilcke, Minnesota Extension Engineer
Jonathan Chaplin, Associate Professor, UM BioAgEng Dept

Recent, dramatic increases in prices for gasoline and diesel fuel make it worth considering possible ways to reduce farm fuel use this spring and summer.

Tractors and Other Field Equipment

Tillage uses more fuel per acre than almost any other field operation. Carefully evaluate your tillage plans and reduce tillage or the intensity of tillage wherever you can. Reducing tillage is also likely to provide the benefit of reducing soil erosion. Make sure, though, to look at your whole cropping system and evaluate whether reducing tillage will create the need for other, more expensive operations.

Avoid compacting soil by staying out of wet fields and by reducing passes with heavy equipment. Extra tillage and extra power (and thus more fuel) are needed to break up compacted soil.

Reduce the number of trips across the field by combining operations where possible. Consider modifying equipment so that you can perform multiple operations in one pass. Think about using a tractor with hitches on both the front and rear (several companies are selling hitches that can be mounted on the front of tractors) so that you can attach implements to both ends of the tractor.

Match the tractor to the load. Avoid using heavy, high-horsepower tractors for operations that don't require much power.

If you do end up using a high-horsepower tractor to pull a light load, gear up and throttle down. You can usually save quite a bit of fuel by running an under-loaded tractor in a higher gear but at a lower engine speed. Make sure, though, that you don't overload the engine; if the engine speed doesn't change quickly when you change the throttle setting, you should probably shift down a gear. Also, gearing up and throttling down might not work for PTO-powered implements since the PTO will operate at lower speed when the engine is run at less than rated speed.

Inflate tires to appropriate pressure. Inflation pressure is an important variable for traction efficiency, tire life, and ride comfort - especially for radial tires. Check your tractor owner's manual and/or the tire distributor for suggestions on inflation pressure.

Add the appropriate amount of weight for the load. Tractor weight, or ballast, helps control the amount of drive wheel slippage. Drive tires should slip about 15% when the tractor is pulling a load in the field. Slip can be checked by comparing the distance traveled for a certain number of wheel revolutions when the tractor is

pulling a load to the distance traveled when the tractor is not pulling a load. Higher levels of slip cause excessive tire wear and poor fuel efficiency. Lower levels of slip indicate that the tractor is carrying too much weight, which wastes fuel and puts an extra load on the axles and power train. Ideally, weights should be added or removed to match the load when tractors are used for different field operations. If you can do so without causing excessive soil erosion, lay out fields to minimize the amount of time spent turning around and the amount of time needed to haul loads of harvested crop back to the road.

Try to minimize the amount of time spent driving tractors and other field equipment on the road. Try to keep tractors and other equipment in the field and use faster, more fuel-efficient vehicles to service vehicles in the field and to haul harvested crops to storage.

Other Farm Vehicles

Use more fuel-efficient vehicles for making trips to fields or to town when you are not hauling heavy loads. Although heavy-duty pickups and trucks play an important role on farms, they are often used for trips that do not require their power and hauling capacity. These vehicles generally consume a lot of fuel per mile and they consume a significant percentage of the liquid fuels used on farms. Much fuel could be saved by using smaller, fuel-efficient vehicles and by combining trips rather than making a separate trip for each errand.

If you are planning to buy large, heavy-duty trucks, consider diesel engines instead of gasoline. Although diesel fuel is often more expensive per gallon, you get much more work out of a gallon of diesel fuel than you do a gallon of gasoline.

A recent study by Douglas Tiffany (U of M Applied Econ Dept) and Dwight Aakre (North Dakota State University Ag Econ Dept) reported the following average diesel fuel use per acre for common upper Midwest crops:

Crop	Average On-Farm Diesel Fuel Use gallons per acre
Alfalfa	9.80
Corn	9.37
Soybeans	7.43
Sugarbeets	40.33
Wheat	7.24

Using fuel prices of the last few years and usage figures from the table, farmers would have spent about $10 per acre for diesel fuel to produce corn. If diesel fuel price per gallon doubles, the cost would be about $20 per acre. On a total farm basis, doubling of fuel prices represents a major increase in costs. But it is important to keep things in perspective and avoid making management changes to save fuel that would result in decreases in yield or increases in other costs. For example, a substantial management change that cuts fuel cost by $5 per acre, but cuts yield by 5 bushels per acre, would probably not be cost effective.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Cornering Concerns in Soybeans before Seeding

Cool, wet conditions can cause soybean seedlings to die while emerging in saturated areas of the field. Usually caused by damping-off, a symptom caused by several diseases, this problem can delay if not kill seedling emergence in soils due to stress on the soybeans such as temperatures below 60F, water-saturated soils, sealed soil surfaces or even deep planting (proper planting depth for soybeans is one to one and one/half inch with a maximum depth of two inches).

Relative Emergence of Soybeans from Different Planting Depths (from research of the University of Illinois with emergence based on that obtained for a one-inch depth set at 100% emergence).

Planting Depth (inches)	Relative Emergence (%)
¾	85.5
1	100.0
1 ½	99.5
2 ½	55.2

Poor-quality seed or even roughly handled seed with cracked or discolored seed coats can help in the initiation of damping-off problems. Move soybeans

carefully in cold weather, especially when loading or unloading in bags or even through augers. Consider brush augers when moving soybean seed used for planting.

Too Wet or Too Dry Cripples Crops

With longer days already apparent, the question remains if the area will see a dry or wet spring. Either extreme is detrimental to crops. With dry weather, corn and soybeans as well as other crops can lose even germination across fields and have seed remain in the ground longer than normal, leaving ungerminated seed exposed to pest (insect, disease, microbial) problems. In the other scenario, damage to seeded fields that are too wet hinges on the duration of the flooding, crop developmental stage and air/soil temperatures. Once germinated, crops cannot live long under completely submerged conditions with no water flow or drying cycles to provide air movement down to plants. Wet and cool conditions also provide the perfect environment for certain crop diseases, particularly on nonrotated fields that may harbor disease or insects. Corn isn't as durable as soybeans under flooded conditions. Prior to the sixth leaf stage, corn can survive only up to four days underwater. At soil temperatures above 77F, plants may not survive 24 hours underwater. Cooler temperatures, however, do tend to prolong survival. Iowa State research also found that flooding six-inch tall corn for 72, 48 and 24 hours reduced corn yields by 32, 22 and 18% when nitrogen application rates were low (50 lb/A). At high rates of nitrogen fertility (350 lb/A), yield reductions ranged only between 14 to 19% one year and less than 5% the following year the research was done. The conclusion? Give each crop the best management possible such as fertility needs as well as correct depth of planting, seeding population and weed control to help optimize each crop's chances at survival no matter what curves from the normal the spring sends.

With Integration Enters More Diversity but Not Weed Worsening

Recent research from the University of Waterloo in Ontario suggests that changes in farming systems increase biological diversity (weeds, invertebrates, vertebrates) in fields. Above ground and seedbank weed species were more diverse in both decreased tillage and more complex crop rotations situations. The greatest weed species diversities found were in fields that were no-tilled and had at least a three-crop rotation of corn-soybeans-winter wheat. While diverse weed seed was found, this didn't mean the above ground (emerged) weed density was greater. With the decreased tillage and more complex crop rotations, the no-till system particularly tended to cause increased desiccation of weeds, increased destruction of weeds by herbivores and parasites and increased effectiveness of properly applied herbicides. Mean weed seed density in no-till fields decreased from 38,000 to 11,000 seeds per meter cubed of soil (49,704 to 14,388/yd3) from 1994 to 1998 while remaining constant around 49,000 seeds per meter cubed of soil (64,092/yd3) in moldboard plowed fields. In the no-till fields with an increased array of weed seed species, crop yields were not affected by this diversity nor from any factor related to tillage or crop rotation tested in this research.

Weed is a Sight for Sore Eyes

A recent weed sample identified through the University of Minnesota Clay County Extension office by Jim Stordahl was a perennial shrub that is native to the United States and known as a buckbrush (coralberry). This weed usually is around two to four feet tall and has smooth, opposite, green leaves that are whitened or lighter in color on the lower surface. The fruit is a drupe that is nearly globe-shaped to elliptic and when flush in the prime in August to September (flowers in July to August) is showy with coral or pink to red or purple fleshy fruit with two seeds in each drupe. The seed are egg-shaped, small and flattened on one side. The root system on this weed can be substantial with rhizomes that form large colonies. Often found in rangeland or woodland, the weed prefers more moisture as is found along ravines or streams. While worthless for cattle, it is a browse plant for deer and pheasants, quail, prairie chickens, sharptail grouse and even songbirds will eat the fruit and seeds. Good cover for larger upland game mammals, the plant may also harbor waterfowl under its stems. Native Americans are said to have used this weed as a wash for sore eyes (from steeped buckbrush leaves) and the fruits were eaten during periods of famine with boiled fruits fed to horses as a diuretic.

Weather Wizens or Wizards Up Weeds

Knowing not only when weeds begin to emerge but what conditions activate germination help improve weed management. Initial emergence dates for weeds vary from year to year, however, the emergence sequence according to research collected by the North Central Region Integrated Pest Management Program is fairly constant if conditions are right. Early weeds can emerge before corn planting with species such as giant ragweed, lambquarters, Pennsylvania smartweed and even common sunflower rearing to go and requiring less than 150 Growing Degree Days (GDDs with base 48). Emergence right around corn planting time may include common ragweed, velvetleaf and giant foxtail that

require 150 to 300 GDDs. A third grouping in weed emergence timings are at the end of corn planting season with yellow foxtail, black nightshade, common cocklebur as well as wild proso millet galloping up in 250 to 400 GDDs. Much later emerging weeds, GDDs more than 350, include large crabgrass, fall panicum, waterhemp and morning glory. Many weed species emerge during a short time period (two to three weeks) but others may prolong this introduction period.

Look also at the weather to predict weed woes. Some like it wet and some like it dry. Biennial wormwood prefers wet conditions while absinth wormwood prefers drier soils. Field bindweed can persist and spread on most noncultivated areas and even most cropping systems but really outshines many other weeds in stressful dry conditions. Canada thistle thrives where its rhizomes contact deep and moist soils; annual sowthistle just wants to have fun in moderate-moisture soils where no cultivation will get in the way of its lifecycle; and, musk thistle likes the dry or rich life, flourishing in sandhills but also seen in fertile lowlands. Leafy spurge is most at home in subirrigated (high water table) sites or even in ditches although a seasoned weather traveler with its rhizome root system. Both diffuse and spotted knapweed migrate to sandier soils but the aggressive Russian knapweed likes to plant its sturdy rhizomes in soils with good water holding capacity. Purple loosestrife has less stress under very moist soil conditions while yellow starthistle, like spotted knapweed, strives to seek sandier soils. Have one of these weeds out-of-place? You already have one trump card toward control in hand if the weed exists in a less preferred environment or weed emergence sequence.

Examine the Enzyme for Resulting Resistance is the Key to Control?

In the newest research from Kansas Agricultural Research Service (ARS) scientists on Bactillus thuringiensis (Bt), it may be a case of the "missing enzyme" that causes insect resistance to Bt. The recent discovery of the absence of a specific gut enzyme in certain Indianmeal moths, has lead to the hunt for other strains of the moth as well as other insect pests such as corn earworms that may also have a similar "missing enzyme." Two strains of Indianmeal moths lack an enzyme for converting Bt protoxins to activated toxins that kill the insects. This "missing enzyme" has been shown to be genetically linked to insect resistance to Bt. Used now for over 35 years, the canned Bt soil bacterium has been a safe and effective alternative for controlling moth pests but insect resistance is occasionally reported in areas of extensive use. This new research hopes to unravel the combination of events that cause insects to cease responding to Bt toxins in order to prolong the use of this safe control as has currently lead to success in transgenic crops such as Bt corn and cotton.

Don't Crowd Canola with Weeds

Herbicide-tolerate canola varieties have increased interest in proper timing of herbicide applications. In studies run in Manitoba, plots of canola were kept weed-free for increasing lengths of time to find the minimum weed-free period required to maximize yield. In a second set of plots, weeds were left in the crop for increasing lengths of time to find the maximum tolerable weed-infestation period. These trials were performed at three sites in southern Manitoba during 1998 and 1999. A Roundup-tolerant canola variety was used within the plots. Preliminary results from the research show that canola requires the removal of weeds (maximum weed-infestation period) at least by the fourth to the eighth leaf stage and that really to optimize canola production, the minimum weed-free period should be right after the second to the fourth leaf stage (most weeds have emerged by this time). Early conclusions show that good weed control early in canola is essential to maintaining yields.

A Reminder: Read Yard & Garden Line News

Deborah Brown, Extension Horticulturist

If you're looking for information about home gardens, lawns and landscapes, let me remind you to check the Yard & Garden Line News, on the internet. Beginning April, it will appear on the 1st and 15th of the month. Previous issues are archived for easy availability.

The newsletter, which runs twelve or more pages each edition, is illustrated with clickable photos. Articles are written by University specialists and County Extension Educators, covering a wide expanse of timely topics such as choosing the right rootstocks when you buy apple trees. Find the newsletter by going to the Extension home page and clicking on Yard & Garden Line on the right side. Scroll down the right side of Yard & Garden Line's site to click on Yard & Garden Line News. Archives are listed in the same column, directly below it.

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

Volume 6, No. 3 **www.extension.umn.edu** **March 10, 2000**

In This Issue

Soybean Cleaning

Bill Wilcke, Extension Engineer

A number of farmers are interested in conditioning soybeans from their 1999 crops for use as seed in 2000. Here are some soybean seed conditioning tips gleaned from a variety of articles and extension bulletins and from the Iowa State University Seed Science Center.

- Make sure that you are not violating an agreement with the company from which you bought the 1999 seed, or that you are breaking some other seed law by using soybeans from your bins or your neighbor's bins.

- Avoid using seed from fields that had disease problems that might be transmitted with the seed.

- Conduct a germination test before going to the trouble and expense of conditioning soybeans for seed.

- There are a number of custom seed cleaning operations in the region and it might be worth hiring them to condition soybeans for you. Late winter can be a busy month for seed handlers, however, and it might be difficult to get on their calendars.

- Normal grain augers, which have steel flighting, can cause a lot of seed splitting, seed-coat damage, and germination loss. If you must use steel augers when you move seed beans, run the augers slow and full. Pneumatic conveyors can also cause a lot of damage to seed; if you use a pneumatic conveyor, adjust the air to seed ratio for minimum damage and avoid bends - especially sharp ones, in the tubing. Also, avoid use of centrifugal bucket elevators

(ones that operate at high speed and throw material from buckets at the top of the elevator). Belt-type conveyors and augers with nylon bristles attached to the outer edge of the flighting cause less damage to soybean seed than other types of conveyors.

- High-speed impacts damage seed and reduce germination. Minimize rough handling and long drops when moving beans and try to limit the number of times that beans are moved. Flow retarders in down spouts and bean ladders in storage bins can reduce bean velocity and damage during bin filling. Avoid use of mechanical grain spreaders during bin filling because spreaders sling seeds at high velocity and cause more impact damage.

- More seed damage and germination loss occur when soybeans are handled at moisture contents below 10% moisture (wet basis). Seed damage tends to be lowest when beans are handled in the 11 to 14% moisture range. Beware though, that mold damage can occur when soybeans are stored above 12% moisture during warm weather.

- More seed damage and germination loss occur when soybeans are handled at low temperatures. A study at Iowa State University showed greater damage to beans handled at 17 to 26F than at 65F. If stored soybeans are much colder than 50F, it might be worth aerating them with 40 to 60F air to warm the beans before they are unloaded from the storage bin and conditioned. Be careful, though, because condensation occurs when cold seeds are aerated with warm, humid air; make sure the fans run long enough to move the warming front all the way through the bin and re-evaporate the condensed moisture.

- If you are only going to use one piece of seed conditioning equipment, the air-screen cleaner appears to be the best machine to use for soybeans. The glossary in an extension bulletin on seed conditioning says that an air-screen cleaner "separates seed on the basis of size, shape, and density; uses multiple screens to first scalp the seed and finally grade it; and contains fans to remove light, chaffy material." Additional equipment that is sometimes used in soybean conditioning includes spiral separators, gravity separators, and aspirators.

This Crazy Weather And Fall-Applied Nitrogen

George Rehm, Extension Soil Scientist

We'll all agree that the Minnesota weather for the past six months has been very unusual. Because of limited rainfall last fall, many crop producers had ample time for application of nitrogen fertilizers. With the warm temperatures of the past two weeks, some are concerned about the fate of the nitrogen applied at that time.

Considering the warm temperatures of last November and December, the nitrogen was probably converted to NO_3-N before the snows and cold weather arrived. This conversion probably occurred for both urea and anhydrous ammonia applications. Although converted to NO_3-N, is fall-applied N still in the root zone? This is a question on the minds of many crop producers.

Although there is always a potential for loss of fall-applied N, the probability of N loss this spring is relatively low. Denitrification and nitrate leaching are the two potential pathways for loss of N applied last fall. Nitrogen loss by either pathway requires excessive amounts of rainfall combined with other factors.

The denitrification pathway requires saturated soil, warm soil temperatures (higher than 60° F) and the presence of soil organic matter. The organic matter

is always present; but, we don't have warm soil temperatures, excessive soil moisture, and saturated soils. So, potential for loss of NO_3-N due to denitrification is low at this time.

Loss of NO_3-N to leaching also requires the movement of water through the root zone. This downward movement of NO_3-N will occur only if there is excessive water in the root zone.

In general, subsoil moisture is low in most of the fine-textured soils in southern Minnesota. Estimates vary, but rainfall in excess of 6 inches will be needed between now and the end of April for much of southern Minnesota before loss of N applied last fall will be a concern. Although the weather can change rapidly, the probability of getting that amount of rain is not high.

The weather conditions experienced in the fall of 1999 and spring of 2000 are unusual and should not be anticipated each year. It's still important to delay fall application of fertilizer until the soil temperatures at the 4-inch depth drops below 50° F. Of course, fall application of fertilizer N is never suggested when soils have a loam, sandy loam, or loamy sand texture. Fall application of fertilizer N is also not recommended for the silt loam soils of southeastern Minnesota.

Chemical Weed Control

Curtis Nyegaard, Extension Educator

(This is the last in a series on I.P.M.)

Herbicides have become the main management tool for most farmers in North America. However, some farmers have become dependent on the use of herbicides as their only method of weed control. Becoming dependent on any one weed management system whether it is chemical, cultural or mechanical can lead to unforeseen problems such as herbicide resistance.

For herbicides to be effective, the farmer needs to determine the best timing to apply the herbicide to the weeds that are causing a problem. Herbicides also need to be used in conjunction with tillage practices that are cost effective and at the same time provide protection to the environment. To determine the best application time for a herbicide includes knowing the kind of weeds involved, the type of herbicide needed, tillage operations and the crop involved.

Fall Application - This is an effective and recommended strategy to manage many perennial weeds such as quackgrass and dandelions. Systemic herbicides that need to move down into the root system to give better control works better in the fall. At that time, the plants are sending sugars down to their roots or rhizomes for winter survival and will move the herbicide down as well. In addition, winter stress also helps to kill herbicide-injured weeds. In the spring, the sugars and nutrients and water are moving up through the plant which t allows less movement of systemic herbicides to the roots. Preplant Incorporation (PPI) - This is a method that is required for herbicides that are volatile or broken down by sunlight. However, non-volatile herbicides can also be applied PPI. Secondary tillage is mandatory following broadcast applications of volatile and sunlight sensitive herbicides to mix them into the top 2-3 inches of the soil. Some herbicide labels recommend two secondary tillage operations performed at 90 degrees to each other for uniform herbicide distribution. However, most growers use a single pass that includes both the spraying and the incorporation. The advantage of PPI is long-term consistency in weed control. Regardless of rainfall, the herbicide will be in the soil and available to control weeds. The disadvantage of this method is that "streaks" can appear if the incorporation is not thorough and timely. Time and labor requirements are also of concern, especially if the herbicide must be incorporated twice.

Pre-emergence Applications (PRE) - This method is

used for row crops, especially for corn. With this method, the herbicide is sprayed on the field as soon as possible after the crop has been planted and prior to crop and weed emergence. A PRE application can be applied in a band over the row with the area between the rows receiving no herbicide. Weeds in the between row area can then be controlled by cultivation. A PRE application will not be effective unless one or more inches of rainfall occurs within 7-10 days to activate the herbicide. If adequate rainfall does not occur, rotary hoeing may be necessary to kill the first flush of weeds. A PRE should have enough residual properties to provide weed control until the development of the crop canopy.

Post-emergence Applications (POST) - Most of the newer herbicide groups have ingredients that require Post application. That is, applications need to be made when both the crop and the weeds have emerged. Many post-herbicides have residual soil activity allowing them to control both emerged weeds and subsequent weed flushes.

Post-applications are applied only when there are weeds and are considered environmentally friendly because they usually reduce the total amount of herbicide applied to a field. Timing of POST application is critical. If they are too early only a small portion of the weeds are controlled. If applied too late, the competition from the weeds will already have taken a toll on crop yield. Another concern is that potential for crop injury is increased. Drift of the herbicide to a sensitive or non-labeled crop can also be a concern. Chemical weed control will continue to be an important part of integrated weed management. However, for the herbicide to be cost effective and environmentally friendly, the farmer needs to select the best herbicide available for the target weeds and for the crop to be sprayed and determine the best time for the herbicide to be applied.

To make the best decision possible, the farmer can contact the extension service, a certified crop advisor or agronomist and read the label.

Micronutrient Review

George Rehm, Extension Soil Scientist

Zinc (Zn), iron (Fe), copper (Cu), manganese (Mn), boron (B), chloride (Cl), and molybdenum (Mo) are micronutrients essential for plant growth. Small amounts are needed for optimum crop production. The fertile soils of Minnesota are usually able to supply adequate amounts of all micronutrients. There are, however, some situations where one or more micronutrients must be added to a fertilizer programin order to achieve optimum yield. Those situations are as follows.

Zinc is frequently needed in a fertilizer program for production of corn and edible beans. Other agronomic crops in Minnesota have not responded to the application of this micronutrient. The need for Zn, however, is not universal. The soil test for Zn is an excellent predictor of needs. Recommendations for Zn use in a fertilizer program for corn and edible beans are listed below.

Zn Soil Test	Zn to Apply	
ppm	Band	Broadcast
	- - - - - lb./acre - - - - -	
less than 0.25	2	10
0.26 to 0.50	2	10
0.51 to 0.75	1	5
more than 0.75	0	0

There are several products on the market that can be used to supply Zn in a fertilizer program. Research has shown that all sources are equally effective. In other words, a pound of Zn is a pound of Zn regardless of source. Banded applications are less expensive and provide for more efficient use by both crops.

Iron chlorosis continues to be a serious problem for soybean and edible bean growers in western

Minnesota. Iron is not deficient in soils. There is an ample supply. With certain soil conditions, the Fe cannot be taken up and used by plants. To date, application of Fe in a fertilizer program has not cured the problem. A soil test for Fe will not predict iron chlorosis.

Growers who struggle with iron chlorosis should reduce the severity of damage by using other management practices such as variety selection and cultivation. It's important to avoid additional stresses, if possible, when iron chlorosis is a serious problem.

Various trials have been conducted to evaluate the effect of manganese added to a fertilizer program. In all trials, the addition of this micronutrient has not improved crop yield. Therefore, there are no recommendations for use of Mn in a fertilizer program for any agronomic crops in Minnesota.

Until recently, copper additions to a fertilizer program were thought to be important for small grain production on organic or peat soils. However, there is some indication that Cu use may improve yield of wheat grown on very sandy soils with a low organic matter content. At the present time, there is no recommendation to use Cu fertilizers for these situations. Additional research will be conducted in 2000 to provide a more accurate assessment of the need for Cu in a fertilizer program. At this time, the soil test for Cu is only recommended for organic soils.

Boron recommendations are limited to alfalfa production in East-Central Minnesota. However, the soil test for this micronutrient is not very accurate. There is some concern that B may be needed for alfalfa production on the sandy soils of northwestern Minnesota. Recommendations are limited to topdress application of 2 lb. of boron per acre if the soil test for B is less than 1.0 ppm.

The application of chloride in a fertilizer program has been beneficial for production of some wheat varieties in both South Dakota and North Dakota. The recommendations are based on the results of a soil test for Cl. In general, Cl will not be needed in a fertilizer program if 0-0-60 has been used to fertilize previous crops.

Although molybdenum is an essential micronutrient, there is an ample supply in Minnesota soils. It is not necessary to add Mo to a fertilizer program.

The use of micronutrients in Minnesota does not need to be complicated. Needs in any fertilizer program are limited and, except for iron chlorosis, shortages are easy to correct.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

White Mold in Soybeans

Management practices and environmental conditions that promote greater crop canopy are the factors that cause white mold in soybeans. Favored by dense vegetative canopies such as created with narrow row widths, high seeding densities, early planting, high soil fertility and other factors that promote good plant health along with added moisture conditions and temperatures below 85F at flowering, the disease must be managed by careful variety selection and by modifying other management practices. Choose management practices which prevent or slow introduction of the white mold pathogen into fields (rotation to nonhost crops); steadily reduce the number of sclerotia in the soil (shallow or no-till lessens sclerotia density and apothecia number due to quicker destruction of viable sclerotia when exposed to environmental changes and due to a more restricted soybean canopy development in these cooler soil regimes); and, find a management system that lowers white mold potential and maintains yield potential (variety selection). A later planting date and lower seeding rates to prevent thick canopy development as well as controlling broadleaf weeds that are also hosts to white mold help in limiting the potential for the disease in highly contaminated fields.

Venomous Velvetleaf is Viable all Summer

Velvetleaf, also known as Indian mallow, butterprint or buttonweed, is an annual weed that originated in India but has quickly adapted throughout the United States except in far northern regions along the U.S. far-north boundary, areas in northern Wisconsin, Michigan and Maine as well as pockets in south central Texas and southern borders of Arizona, New Mexico and Florida and continues to expand. Flowering anytime from July to October depending on location and season, the continual germination of the prolific seed can cause control concerns particularly in corn and soybean fields as well as waste places, pastures, roadsides and fence rows. The characteristic orange-yellow flowers are similar in color to pumpkin flowers but are much smaller and numerous all along the plant stem. The flowers eventually produce a fruit like a "button" that holds 5 to 15 seeds in each cup. The leaves can get quite large and are round to heart-shaped with a velvety pubescence on the leaf surface. The taproot can support a large, erect stem that also has velvety pubescence. The weed grows most rapidly in the warmest part of the summer (usually after cultivation of crops) and can get quite tall particularly when competing in crops such as corn. Dried stems of the plant can occasionally be seen in dried floral arrangements due to the unique fruit cup but green velvetleaf may cause allergic skin reactions to susceptible handlers. The prolific seeds can be eaten by mourning doves and quail but also can remain viable for years. In a report from 1946, Toole and Brown wrote that velvetleaf seeds in the Duvel buried seed study had 38% of the seed still germinating after 38 years.

Some Weeds are Just Tough to Out-Compete

Field studies run in 1998 and 1999 were used to determine row spacing (7" and 15"), soybean density (just over 100,000 plants/A and 200,000 plants/A) and time of weed removal (at around 3", 6", 9" and 12") for giant foxtail in Roundup-Ready soybeans in Ohio. Initial herbicide treatment was with Roundup at 2 pints ai/A. Additional treatments were added that allowed a sequential Roundup application of 1.5 pint ai/A at the 3" and 6" weed heights (two to three weeks after the planting). At one site, soybean density was increased and reduced row spacing led to increased yield. At another site, however, yield increased as row spacing increased. Statistically across the locations, row spacing and soybean density had little effect on the control of giant foxtail even with one location having all treatments providing 100% weed control. Soybean yield was severely reduced, however, when weeds reached 12" before any Roundup treatment was applied. One site, showed yield reduction even when giant foxtail was treated at 6". The trend across locations in this study showed lower soybean yields when Roundup was applied only once.

Residual with Roundup Appearing More Reliable

Studies run in 1998 and 1999 in Minnesota and reported at the 2000 Weed Science Society of America meetings has shown that soybean yield is more easily maximized if weeds are controlled from the time of Roundup-Ready soybean planting. Faster crop seedling growth and establishment on top of weed control are cited as important production practices. Treatments including soil-applied residual as well as a non-residual, total-post systems were established to monitor control of giant foxtail, giant ragweed and common sunflower. Residual systems in the studies included: Pursuit + Prowl (PPI); Pursuit + Prowl (PPI) followed by Roundup (POST) and Pursuit + Roundup applied early postemerge (POST). The nonresidual treatments included: Roundup (applied at 24 or 32 days after planting) followed in a later POST treatment with Roundup. Soybean yields were about 10% higher when residual herbicides were used and even during the season soybean growth rates as determined by dry weight samples were better in the residual herbicide system. Soybeans in the total POST, non-residual systems had weed competition for the first 32 days after planting but had higher late-season growth rates. However, this late-season growth did not allow for complete recovery of yield potential in these studies. Relying on late-season growth to compensate for early season weed competition is especially risky in seasons of dry weather or an early frost.

Herbicide Adheres to Organic Matter and Abhors Weeds

A commonly used herbicide, glyphosate, is now found sold under a wide array of trade names, including the original name of Roundup. It is a broad-spectrum, non-selective systemic chemical that is highly active on most annual and perennial plants. Extensive toxicological studies have been performed on this herbicide as it is so widely used. Tests on the fate in humans and animals have shown that the chemical (either technical product or the formulated product) is poorly absorbed from the digestive tract and is excreted unchanged by mammals with no long-term tissue accumulation of the chemical. Environmentally, glyphosate is easily absorbed on most soils especially when the soils are high in organic matter. Microbial degradation occurs to the chemical with the half-life in soils from 3 to 130 days, depending on microbial activity. In water, the tested chemical half-life is only 12 days to 10 weeks with degradation influenced by microorganisms which help breakdown the herbicide in water. In forest vegetation, the half-life is less than 4 weeks. Sunlight plays a very minor role in environmental breakdown of this chemical. Once in plant tissue, this herbicide is known to translocate throughout the plant and even into the roots. However, different weeds may influence this process. Roundup is extensively metabolized by some plants while remaining intact in others as explained in Grossbard's and Atkinson's book, "The Herbicide Glyphosate," which was originally printed in 1985 by the Butterworths publishing firm out of Boston, Massachusetts.

Plant Disease Clinic

Sandee Gould

Samples submitted to the Plant Disease Clinic in Jan. and Feb. included:

corn: cultured for grain storage molds
wheat: cultured for grain storage molds
haylage & silage: cultured for grain storage molds
barley: tested for loose smut
lilac: *Phytophthora* sp stem rot, *Thielaviopsis* sp root rot
geranium: tested for *Xanthomonas campestris* pv *pelargonii* (bacterial wilt). We have NOT had any positive tests for wilt yet this season.
orchid: *Colletotrichum* sp leaf spot
Dianthus: *Colletotrichum* sp stem rot
coleus: Impatiens necrotic spot virus (INSV)
N.G. impatiens: *Pythium* sp root rot, INSV
Fuchsia: INSV
Chrysanthemum: INSV
spikes: INSV
Salvia: INSV
daylily: *Collecephalus* sp leaf streak
Ajuga: alfalfa mosaic virus (AMV), cucumber mosaic virus (CMV)

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CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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In This Issue

The Mehlich III Extractant

George Rehm, Extension Soil Scientist

Soil testing laboratories have always searched for ways to reduce the cost of the analysis of soil samples. A universal extractant that could be used to extract all essential plant nutrients would be attractive. Rather than use a specific analytical procedure for each nutrient, the soil could be mixed with a universal extractant and the nutrients would be measured in this one extractant.

Various researchers over the years have suggested or formulated several universal extractants. The Mehlich III extractant was developed for use as a universal extractant and has been accepted for use in many states in the eastern Corn Belt.

Researchers have compared the amount of potassium measured in a Mehlich III extract with the amount found in the traditional ammonium acetate extract. The values are nearly the same for both extracts. Therefore, amounts of potassium extracted by both the ammonium acetate and the Mehlich III procedures can be placed in the same categories. No adjustments in numbers are needed.

There has always been a question about the accuracy of the Mehlich III procedure for measuring phosphorus in soils. In Minnesota, soil samples were collected from five fields as part of a study to evaluate variable-rate fertilizer applications for both corn and soybeans. These samples were analyzed for phosphorus by the Bray, Olsen, and Mehlich III procedures. Crop response to phosphate fertilization was compared to the amount of phosphorus extracted by these three analyltical procedures. When the Mehlich III procedure was

used, the phosphorus in the extract was measured by both colorimetric and ICP procedures.

Numerous measurements of phosphorus by the Bray, Olsen, and Mehlich III procedures have also been conducted by Dr. Antonio Mallarino of Iowa State University. After evaluation of the data collected in both Minnesota and Iowa, we make the following recommendations if the Mehlich III procedure is used to extract soil phosphorus for the purpose of making phosphate fertilizer recommendations:

- Use the definition of categories currently used for the Bray procedure. For example, a value in the range of 6 - 10 ppm measured by use of the Mehlich III procedure would be considered to be in the low range.
- extracted with the Mehlich III extractant should be measured with colorimetric rather than the ICP analytical procedures. Use of the Inductively Coupled Plasma (ICP) method could lead to incorrect results and subsequent errors in fertilizer recommendations.

The Mehlich III extractant is not an improvement over the Bray and Olsen procedures. The Olsen procedure is still the most appropriate for measurement of soil phosphorus where soil pH values are 7.4 or higher.

In Minnesota, the use of Mehlich III procedure does not improve our ability to make more accurate recommendations for phosphate fertilizers.

Lime For Soybeans In Southern Minnesota

George Rehm, Extension Soil Scientist

The pH in the surface soil (0 to 6 inches) of many fields in southern Minnesota has dropped substantially in recent years. In many cases, the pH is now in the range of 5.6 to 6.0 when it used to be above 7.0. The general recommendation is to use lime for soybean production when soils become acid. Will the application of lime increase soybean yields when soils are acid in southern Minnesota? This has been a frequent question from soybean growers in recent years.

Even though the pH of the surface soil is acid, the pH of the subsoil remains near 7.0 or above. The benefit of the use of lime in these situations can be questioned.

Studies were conducted at two locations in southern Minnesota in 1999 in an effort to get answers to some of these major questions. The locations were the Southern Research and Outreach Center at Waseca, and the field of a cooperating farmer in Jackson County. The soybean yields measured in the study are summarized in the tables that follow.

At Waseca (Table 1), the lime was applied and incorporated in the fall of 1998. The 1999 soybean yields were excellent and the application of both dolomitic and calcitic lime had no effect on soybean yield.

In Jackson County (Table 2), the lime was broadcast and incorporated in the spring of 1999. Two varieties were planted at this site. When averaged over the two varieties, the application of lime had no significant effect on soybean yield. The use of dolomitic lime did not have a negative effect on yield. The results of these trials conducted in 1999 indicate that lime use does not have a positive effect on soybean yield even though the initial soil pH at both sites was 5.6.

Improved nodulation is usually mentioned as one of the benefits of liming. Soybean plants taken from plots receiving various rates of lime in Jackson County were dug in July and examined for nodule development. There was no apparent effect of rate of lime applied on either nodule number or nodule development.

Table 1. Effect of the application of lime on soybean yields at the Southern Research and Outreach Center, Waseca.

Liming Material	Rate Applied	Yield
	ton/acre	bu/acre
-	0	59.0
dolomitic	0.5	57.0
dolomitic	2.0	56.5
dolomitic	4.0	59.9
dolomitic	6.0	59.2
calcitic	0.2	58.4
calcitic	0.5	59.3
calcitic	1.0	59.3

Table 2. Influence of dolomitic and calcitic lime on the yield of soybeans. Jackson County.

Liming Material	Rate Applied	Yield
	ton/acre	bu./acre
none	-	41.0
dolomitic	2.0	42.9
calcitic	2.0	42.1
calcitic	4.0	44.2

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MINNESOTA CROP NEWS

From the Crops System Team of the University of Minnesota Extension Service

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Field Pea

Hans Kandel, Red Lake County Extension Educator

Field pea is an annual, cool-season legume crop. Each leaf has a branched tendril at its tip and one to three pairs of leaflets. There are two main varieties of field pea. One type has long vines (2- 4 feet in length) the other type is a bush or dwarf type. Field pea plants are classified by the color of their seed, which is green or yellow. Field pea seeds have extremely low levels of fat, moderately high levels of protein, medium levels of carbohydrates and relatively high levels of fiber compared to soybean.

Field pea is well adapted to cool climates. Optimum yields are obtained at 55 to 65 degrees F. Extremely hot weather, especially during flowering, can drastically reduce seed production. Pea seed needs to be inoculated with the proper Rhizobia strain bacteria (C type). A sticker is recommended to attach the inoculum to the seed. Young field pea plants are tolerant to frost. When seeded early in the spring field pea will reach maturity in about 95-100 days after emergence. Field pea will perform well when moisture is available during the early growing season of the plant and rainfall is limited during the pod fill and ripening.

The following table provides results for the 1999 season in Kennedy, Kittson County. Also included are the combined results over 8 test sites. Among the varieties tested, Majoret and Astuce have a green seed coat. For more information call Hans Kandel at 1-800-770-1244.

Pea Variety Trial Results 1999.

Pea variety	Kennedy 1999 Yield Bu per Acre	Kennedy 1999 Test weight Lb. per Bu	Mean 97-99# Yield Bu per Acre
Spitfire	56b*	63.8ab	62.7a
Carneval	53.7bc	63.8ab	57.6ab
Carrera	65.5a	64.4a	56.2bc
Grande	49.7bc	64.0ab	56bc
Highlight	49.6bc	64.1ab	54.7bcd
Majoret	52.8bc	64.6a	52.1bcd
Mustang	48.3c	63.2b	51.7cd
Profi	51.9bc	63.3b	49.8d
Integra	68.2a	64.1ab	
Astuce	63.5a	63.6ab	
L.S.D (0.10)	7	1.1	5.6

* Values in the column followed by the same letter are not significantly different at p<0.10
# Mean of Red Lake Falls, Fosston, Oklee and Kennedy 1997, Lake of the Woods, Red Lake Falls and Fosston 1998, and Kennedy 1999. Each site had four replicates.

Farmland Tile Drainage Design Workshop: Feb 29 - Mar 2nd

Jerry Wright, Extension Engineer
West Central Research & Outreach Center- Morris

A three-day workshop on farmland water management and tile drainage design will be held on February 29th thru March 2nd at the Southwest State University campus in Marshall, Minnesota. The first two days will cover basic subsurface tile drainage design. The third day will cover current drainage issues, research project and technology updates.

Workshop is intended for agriculture tile drainage contractors, farmers, landowners, crop consultants, soil water technicians, decision-makers and others.

Pre-registration is required by February 16th.
Registration fee schedule is as follows.
3-days (Feb. 29., March 1, 2): $135.00
2-days (Feb. 29, March 1): $100.00
1-day (March 1 only): $ 55.00
Application has been made for CCA accreditation for 10.0 CEU for February 29 and March 1; 6.0 CEU for March 2.
Seating is limited to 60 for the first two days. Contact Jean Spohr at (320-589-1711 or **spohrjm@cda.mrs.umn.edu**) for registration materials or Jerry Wright, Extension Engineer (**jwright@tc.umn.edu**) at the University of Minnesota - West Central Research and Outreach Center in Morris, Minnesota.

Program on February 29th and March 1st will include discussion on tile sizing, lateral spacing, Minnesota Drainage Guide, economics, environmental impacts, contractor responsibilities, and computer aided design software. Example problems will be presented during the design presentations. Discussion will be lead by Minnesota Extension & NRCS specialists, researchers, contractors and state agency adviser.

On the third day, March 2nd topics will include Ohio drainage experiences and research (Larry Brown, Extension Engineer – Ohio State University), constructed wetlands, environmental concerns, public drainage laws, surface tile inlet alternatives, computer aided design programs, GIS, surveying 101 and contractor experiences with different tiling machines.

The workshop is being sponsored by the University of Minnesota Extension Service, Minnesota West Community & Technical College-Canby and Southwest State University in partnership with the Minnesota Land Improvement Contractors Association.

Native Grasses as Living Snow Fences

Gary Wyatt, Extension Educator, Watonwan County
Amy Negium, District Conservationist, NRCS, Watonwan County

If you lived in Minnesota during the winter of 1996-97, you will remember the blowing and drifting snow and treacherous winter driving conditions. Landowners now have the opportunity to reduce the amount of blowing and drifting snow on roadways and get paid well to do it. The program is called "Living Snow Fences". Traditionally, living snow fence plantings have consisted of either trees or shrubs. In the last Farm Bill, native grass plantings were accepted as an

eligible practice.

Some landowners are hesitant to plant trees or shrubs in row crop fields because they are uncertain how this will affect the land value or resale of the property. Also, at the conclusion of the program, if the payments end, re-establishing a row crop practice on the land taken out of production is an option. Generally, it is easier to plow up native grass plantings than trees or shrubs.

The benefit to cost ratio for living show fences is $17 in savings for every dollar spent for a 30 year planting (figured at only $1/ton snow removal expenses). These figures only include savings from reduced snow removal costs. Additional savings from improved highway safety - resulting in fewer accidents, less property damage, and fewer injuries and fatalities - plus the saving to commerce with fewer transportation delays will increase the benefit-to-cost ratio by four or five times.

City, Township, County and State government officials are identifying areas where snow drifting occurs on an annual basis and are considering options to reduce snow drifting to roadways in the future.

A program in the 1995 Farm Bill (Continuous CRP) offers landowners an incentive to establish living snow fences in order to reduce potential snow drifting problems to roadways. Almost all landowners are eligible for this program. One of the main requirements is that land must have been farmed 2 out of the last 5 years.

There is no competitive bid process. This means that if your land and plan qualify, you have a good chance of being accepted in the program. One of the best incentives is the price for land taken out of production. Landowners are paid based on the cash rental rates of the soil types on their land. In South Central Minnesota, these land cash rental prices can easily range from $90 to $110 per acre. Costs sharing up to 50% of the planting expenses are also available.

The living snow fence program is under the **"Continuous Conservation Reserve Program"** (CRP) and is offered through the Farm Service Agency (FSA) and National Resource Conservation Service (NRCS) offices in each County. Since the winter of 1996-97, the state of Minnesota applied for and was awarded a FEMA grant to help establish more living snow fences to prevent/reduce the amount of blowing and drifting snow conditions on rural roadways. Several counties have applied for these FEMA funds that will increase farmer incentives to over $3,000/A total payment (paid over 15 years) for a planting that will exist and be effective for 30 years. Most of these plantings are 45 feet wide with 2 rows of trees and/or shrubs or tall (4-5') native grass strips, 15 to 25 feet wide. Switch grass, Indian grass and Big Blue Stem are the most beneficial species.

If a native grass planting is designed, 2 strips in the field are recommended. The strips should be with in 50 to 100 feet of each other depending on row crop equipment. A strip 25' by 2,000' equals 1.15 Acres. If 2 strips are planted, then the landowner would be paid for 2.3 Acres, at $3,000 per acre (for the FEMA Counties) the landowner would receive a total of $6,900 after 15 years for a planting that would exist for 30 years.

The main challenges in establishing living snow fence plantings include: location of tile lines, management of broadleaf post-emergence herbicides, and potential planting delays in the spring due to drifts in the field. With proper planning and crop management practices living snow fences can be successful.

The benefits of this program are more than just landowner compensation; they include the benefits to neighbor, community, county and regional residents in the areas of safety, aesthetics, economics and wildlife.

If you think you might have land that may be eligible for this program, please call the FSA/NRCS office in your county for an appointment.

Check Out Yard & Garden Line News

Deborah Brown, Extension Horticulturist

A number of subscribers to Crop News enjoyed the articles about home gardening, landscape, insects, and plant diseases that were submitted regularly by staff of the Dial U Clinic. That clinic has been supplanted by a service called Yard & Garden Line, and its staff now put together their own newsletter, aptly named Yard & Garden Line News.

Contributors to the Yard & Garden Line News include regulars Deb Brown (horticulture), Chad Behrendt (plant pathology), and Jeff Hahn (entomology), as well as a host of county extension educators and other U of M specialists, covering a wide range of timely topics. Yard & Garden Line Coordinator Beth Jarvis edits the newsletter and rides herd on authors to make sure each issue is packed with good information.

We'd like you to check out this newsletter on the internet. It is only published electronically, and is available to anyone

who is interested. We collect no subscription fee. The easiest way to access Yard & Garden Line News is to start at the Minnesota Extension Service's website **http://www.extension.umn.edu** then scroll down the right hand side of the screen and click on "Yard & Garden Line." From there, scroll down the right side again, and click on "Yard & Garden Line News" to give you the current issue. Most articles are illustrated with photos that can be enlarged by double clicking on them.

The newsletter is published the first of each month, October through March, then twice monthly April through September. All back issues are archived. Back up to where you clicked on Yard & Garden Line News, then click on the line immediately below it, "Yard & Garden News Archive" where you'll find newsletters dating back to April 15th of last year.

Any questions? Call Beth Jarvis at 612-625-5232.

Ridge-Till Conference

George Rehm, Extension Soil Scientist

The Midwest Ridge-Till Conference is scheduled for February 2nd at the New Ulm Holiday Inn. The program will start at 10:00 a.m. and finish at 3:00 p.m. This year's program features discussion of weed control, fertilizer use, and manure application in the ridge-till planting system. There will also be a heavy emphasis on the economic advantages of the ridge-till planting system.

A special invitation is extended to those farmers who are either using or thinking about using the strip-till planting system. Management practices that are appropriate for the ridge-till system also fit the strip-till system. This should be an excellent educational experience for farmers interested in the strip-till system.

For those in the Certified Crop Advisor Program, CEU's have been applied for in each of the four performance areas.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Biotech Beans are a Base for Better Products

Promising new value-enhanced soybeans are beginning to have output traits that are leading to new developments. High oleic soybeans had around 50,000 acres planted in 1998 in the Midwest. These beans yield oil that contains less saturated fat than conventional soybeans. The oil is more stable and does not require hydrogenation for food use, reducing processing costs and limiting the trans fatty acids associated with adverse serum cholesterol levels. Besides the health qualities, the new bean oil has a longer shelf life. Soybeans with improved animal nutrition that beef up the protein and amino acid content of soybean meal are also near commercial introduction. Increased levels of the amino acids lysine and methionine may reduce the proportion of higher cost protein meals required in rations. Besides oil and meal quality improvements, some new soybeans are incorporating additional improved food quality traits. One example is the new high-sucrose soybeans that have a better taste (less "beany") and greater digestibility.

Biotech Corn Connects with Customers

New corn varieties have begun to incorporate in specialty traits that are connecting the farm product to specific customers. Value-enhanced corn will be offered in several improved nutritional packages for livestock feeding. Many varieties aim to increase available energy in the feed source, but other include more protein and better amino acid balances. High-oil corn, developed through conventional breeding, now has an enhanced nutritional profile. The higher oil content means more energy, improved feed efficiency and it reduces the need to add fat to some rations as well as delivering higher levels of essential amino acids like lysine and methionine. Amazingly, this new corn also reduces dust levels and improves palatability with the higher oil content. Low-phytate or low-phytic-acid corn provides increased availability of phosphorous, good for hog and poultry feed where less phosphorous in their waste means less pollution problems. Hard endosperm corn can be used by dry millers for preparing specific food products. And, waxy corn or other altered starch content corn can be used by the wet milling industry.

Connect and Carry Corn Crop with Subsoil Supply and Depth of Planting

With subsoil moisture still substantive for corn production even without additional rains, corn production requirements can be reviewed before even selecting your corn seed. The influence of weather on the corn plant starts even before planting. In many areas, winter precipitation has been low and with a frozen ground, little moisture enters the soil. But not to worry, research done in 1965 showed that usually only 25% of precipitation that occurs on frozen ground ever ends up in the soil-moisture reserve. Thus, much of the moisture received in the winter may not even make it into the field soil profile. With an already higher soil-moisture reserve going into winter, less crop-season rainfall will be required. Spring rains in the Red River Valley also help replenish soil-moisture reserves and upper surface moisture. Besides moisture, germination of corn is also affected by temperature. Corn can emerge in 8 to 10 days when planted if temperatures are 60F

to 64F, but will take 18 to 20 days at 50F to 55F. Optimally, if the soil is moist and an average soil temperature near 69F exists, emergence can occur in 5 to 6 days. Research has also found that corn emergence is delayed one day for each inch increase in depth of planting especially below the optimum 1.5 to 2.5 inch planting depth. This delayed emergence is due to both cooler temperatures and a greater distance involved. Optimize your corn crop by utilizing soil profile moisture and depth of planting to your advantage.

Horror in Hoarding Seed Seen with Sclerotinia

Yet another reason to buy good quality soybean seed has been revealed. In a recent report in the December 1999 *Plant Disease*, USDA researchers have found that soybean seed can harbor Sclerotinia stem rot or white mold. Previously, white mold was thought to only be transmitted through windborne spores of the fungus, in fields already infected or in seed contaminated with infected soil peds (such as seed not cleaned). The study, conducted in both field and lab conditions, found that saved infected seed can transmit the disease, but you might not realize the problem until two years after planting the seed. With the right environmental conditions (usually but not always during cool, moist conditions), infected soybean seed can cause later crop plant infection with white mold and can increase the amount of sclerotia present in the soil for following seasons. So far researchers have not been able to demonstrate any infection from contaminated seed within the same season as originally planting the contaminated seed, but have demonstrated disease initiation on crop plants two years after the initial planting of contaminated seed. This research definitely places a secure spin on the adages stating that good, clean, quality soybean seed should be planted, especially in fields that have never had white mold and that rotations out of Sclerotinia-susceptible crops, maybe even for multiple years, might help in crop productivity and management. Never plant soybean seed saved from a field that was infected with white mold, especially not in fields not known to have ever had Sclerotinia. Confirm the source and clean condition of purchased seed to insure that you are not buying yourself white mold trouble two or more years down the road.

Improve Your Corn Seed Placement

Optimized seeding rates in corn (plant populations) are very important as are planting dates. However, remember too that uniform spacing (seed spacing within the row) also ensures maximum yield and optimal crop performance. Crowded plantings result in crop plant competition for sunlight, water and nutrients that can lead to crowded, barren plants, small ears, stalk lodging and even more ear disease. Research has shown that grain yield can be improved from four to twelve bushels per acre as within-row spacing is improved to the best possible uniformity. Check your equipment before spring to insure uniform plant spacing of corn. First, planter accuracy is based on keeping the planter speed within the range specified by the manufacturer. Read up on minimum and maximum speeds where planting accuracy is best. Second, make sure the planter system is operating efficiently. Air-assisted row planters should be properly operating by matching the air pressure to the weight of the seed being planted; finger pick-ups should be checked for wear on the back plate and brush; older plate-type planters should have the seed grade matched to the planter plate; and, anyone using air-flow planters such as Concords for corn planting should insure that placement is as accurate as possible (no clogging or field trash obstacles) to confirm more uniform spacing. Third, check for wear on double-disk openers and seed tubes as well as make sure coulters and disk openers are properly aligned when used. Fourth, make sure the sprocket settings on the planter are correct when used. Fifth, check any worn chains and improper tire pressure and correct to manufacturer's specifications. Sixth, check or install a planter monitor if possible to check seeding drop as you plant. Improve your corn seed placement in 2000.

Seeding Depth Does Wonders to Corn

Now is the time to ensure that your planter is in good operating condition and ready well ahead of spring planting. Check for and replace all worn parts and clean and lubricate all moving parts thoroughly. Consider taking the seed metering units into your local dealer to have them checked out on a planter stand test. Good calibration of the units will insure accurate seed spacing. Also, consider the seed depth at which corn should be planted this coming spring. Corn should be planted at least 1.5 inches deep. Consequences of uneven seeding depth can mean additional corn stalk lodging and plants more prone to insect and disease problems. If residue or heavy clay soils make depth control difficult, consider setting the depth control for 2 to 2.5 inches deep. This insures a good depth for the corn plant to get the primary (seminal) roots developed and will allow the secondary (fibrous) roots on the corn plant to anchor the plant firmly in the ground. Practically, the 2 to 2.5 inch seeding depth is also wise to use if shallower seed zones are excessively dry. Prepare for the new millennium by making the right decisions on corn planting to maximize yield.

Selecting Sensible Hybrids Limits Green-Snap

In a recent research paper, results were no surprise that showed again that hybrids less prone to breakage (with better standability) limit brittle-snap losses (stalk breakage during the growing season). Run during the 1993 and 1994 seasons with devastating windstorms, the trials in Nebraska gave a snap-shot of the factors which affect corn breakage. Crop rotation, hybrid, planting date, and nitrogen fertilizer and their interactions all affected brittle-snap in 1993. Indeed, treatments that gave corn a shot of rapid, good growth such as optimum to excess nitrogen treatments, corn rotated with soybeans and early planting increased the severity of damage. In continuous corn, only seven percent of the stalks broke compared to 33% for rotated corn. Among hybrids, damage ranged from four to 33%. Breakage increased from 8% with no fertilizer added to 24% with optimum to just above nitrogen fertilization. In 1994, however, only the hybrid factor was significant. So with optimum conditions for plant growth contributing to the possibility of green-snap, what is

a farmer to do? Compare hybrids! Optimum conditions give better plant growth that in turn can give better yields. Don't lose these bonuses to yield from crop rotation and adequate fertilization. Carefully compare hybrid yields and standability before purchasing next year's hybrids. Consider the best standability needs for fields more prone to wind ravages, especially when those fields are in optimum condition for corn growth.

Whether you Weather the Extremes Makes Yield

Weather factors greatly influence the year-to-year variability of crop yields. Which factors are most critical? Temperature and soil moisture, according to a cropping study conducted in Nebraska from 1984 to 1995, are the most critical factors for crop yields. As has been seen here, yields decrease as number of dry days increase. Also, elevated temperatures during August reduce yields. Corn and soybean in four-year rotations with oat/clover-sorghum-soybean-corn were the least affected by high August temperatures in the Nebraska studies, reinforcing the premise that rotations help in conserving soil moisture and providing better growth conditions for crops. Management decisions for cropping rotations should consider the type of system best suited to a given location and the most profitable levels of nitrogen fertilization. Specific precipitation indexes for the months before planting should be used to decide the appropriate nitrogen rate and whether to continue or break the rotation cycle if considering planting corn when rainfall is favorable. These weather variables are very useful management tools. Also consider relative crop prices (and supports), machinery requirements, needs on the farm and other factors when deciding crops, systems and nitrogen rates to promote profitability in any given year as well as for long-term stability.

Smart Shopping on Soybean Succeeds

Keeping in mind the traits that are needed for soybeans to succeed on your farm is essential when deciding what varieties to select for seed. Besides looking at yield data across years and locations, remember the following categories when reviewing field data. First and foremost, choose variety maturities that work in your fields. An earlier variety may develop faster and have fewer leaves when planted late while a later variety may develop slower and have more leaves--both cases limiting yield. Second, consider how the variety is adapted to the temperatures in the region. Length of time between soybean stages will tend to increase with cooler temperatures and decrease with warmer temperatures so optimize yield by choosing an adapted variety. Third, determine what stresses your location and field sites have on growing soybeans and choose variety traits that fit the bill. Deficiencies of nutrients, moisture or other stresses such as disease may lengthen the time period between vegetative stages but shorten the time period between reproductive stages, again, limiting yield. Fourth, go for genetic control when possible with the varieties you choose. Rely on prescription genetics that fit your farm for the soybean you choose to grow. Seed number and seed size varies among varieties but any stress (see number three above) can reduce the number of pods, number of beans per pod and even the size of seeds produced. Preventative risk management includes matching variety genetics to the field location needs. Fifth, decide on your plant density now to determine your seed needs. Consider disease probability and soil-moisture holding capacity as well as planting equipment on hand for each field to determine optimum plant populations.

Plant Disease Clinic

Sandra Gould, Assistant Scientist - Plant Pathology

Samples submitted to the Plant Disease Clinic in December included:

alfalfa---*Fusarium* sp crown rot, *Collectotrichum* sp (anthracnose)
corn---cultured for storage molds, *Pratylenchus* sp (lesion nematode)
wheat---cultured for storage molds
barley---tested for loose smut
sugarbeet---soils tested for Rhizomania
wheat---cultured for storage molds
lilac---*Rhizoctonia* sp root rot
Primula---*Pythium* sp, bacterial stem rot
verbena---*Myrothecium* sp leaf spot
orchid & N.G. impatiens tested negative for INSV and TSWV.
tomato---sent to Entomology

2000 SEASON
SCHEDULE

January 14, 2000
February 18, 2000
March 10, 2000
March 24, 2000
April 14, 2000
April 28, 2000
May 5, 2000
May 12, 2000
May 19, 2000
Mary 26, 2000
June 2, 2000
June 9, 2000
June 16, 2000
June 23, 2000
June 30, 2000
July 7, 2000
July 14, 2000
July 21, 2000
July 28, 2000
August 11, 2000
August 25, 2000
September 8, 2000
September 22, 2000
October 13, 2000
November 10, 2000
December 8, 2000

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