MINNESOTA

CROP NEWS

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

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IN THIS ISSUE

Reminder -- Order 2000 Season Subscription to Minnesota Crop News

If you haven't ordered your subscription for the 2000 season to the *Minnesota Crop News* newsletter, please see the September 24th issue for a subscription form.

Cost of a hard copy of the newsletter is $30.00. New this year, by subscribing electronically you can receive the *Minnesota Crop News* **free of charge**. The newsletter will be e-mailed to you the day it goes to the printer. If you would prefer receiving the newsletter by e-mail, fill out the subscription form in the September 24th issue or e-mail ddrange@extension.umn.edu to subscribe electronically. If you do not have your September 24th issue, you may call Deb Drange at (612) 625-6290, or e-mail at the above e-mail address.

2000 AG PROFESSIONAL UPDATE

Kevin Cavanaugh, Department of Agronomy and Plant Genetics

The 9th Annual Ag Professional Update schedule has been set for the week of January 10-14, 2000. This program is designed for agricultural product dealers, crop consultants, vo-tech instructors, extension educators, and others involved in making crop management decisions for their clientele. This four hour program will update agricultural professionals on the latest research and crop production recommendations from the University of Minnesota Experiment Stations and Extension Service. A total of 3.5 CEU have been applied for at each location. Preregistration and on-site Pregistration will be $40, but attendees are strongly encouraged to register early so as to avoid a late start of the program. The fee includes coffee, refreshment break, and handout materials. To request a registration brochure, contact Tracey Benson at (612) 624-3708 or (800) 367-5363, or EMAIL at tbenson@extension.umn.edu.

Workshop Locations

DATE	LOCATION	START TIME
January 10, 2000	Crookston, Northwest ROC	12:30 p.m.
	Rochester, Best Western Apache	12:30 p.m.
January 11	Morris, West Central ROC	8:30 a.m.
	Mankato, Best Western Hotel	12:30 p.m.
January 12	Worthington, Ramada Inn	12:30 p.m.
January 13	Little Falls, VFW Hall	12:30 p.m.
	Marshall, SW State Uni., BA Bldg. Rm 102	8:30 a.m.
January 14	Willmar, Holiday Inn/Conference Center	8:30 a.m.

Warm Stored Crops are at High Risk for Spoilage

Bill Wilcke, Extension Engineer

Many of our stored grain and oilseed crops are too warm for safe storage and need to be cooled as soon as possible. Much of the 1999 crop was harvested and stored under fairly warm conditions and some of the 1998 crop that is still in storage has undoubtedly become warm since last winter. Crop temperatures greater than 60F are too high for safe storage because molds and insects grow and reproduce rapidly at 60 to 90F. Grain storage managers should take temperature measurements at several points in the bin or pile and if they find temperatures greater than 60F, take actions to start the cooling process.

The best way to cool crops is to use aeration systems to move cool outdoor air through bins or piles. Our target temperature for winter crop storage in the upper Midwest is 20 to 30F. Outdoor temperatures usually reach that range during the first part of December, so that's the ideal time to cool crops for winter storage.

Using aeration to cool crops is not an instantaneous process - it takes some time for the air moving through the bin to remove heat contained in the seeds. The amount of time that the cooling process takes (called a cooling cycle) depends on the airflow per bushel provided by the aeration system. You can estimate cooling time in hours by dividing the number 15 by the airflow in cfm/bu provided by the aeration system. (Airflow in cfm/bu is the total cubic feet of air per minute provided by the fan or fans divided by the number of bushels of crop in the bin or pile.) For example, a common airflow provided by aeration systems is 0.1 cfm/bu, so cooling time for these systems would be approximately 15 divided by 0.1, or 150 hours. This is the approximate number of hours of fan operation required for airflow of 0.1 cfm/bu to reduce the temperature of the crop in a bin or pile to the average outdoor temperature.

Once the crop temperature throughout the bin or pile has reached the outdoor temperature, the fan can be turned off. If the crop temperature did not reach the target values of 20 to 30F, wait for weather to cool a bit more and then run the fan for another cooling cycle.

If the storage facility does not have an aeration system to move air through the crop, natural cooling will take a very long time and significant spoilage might occur before the crop cools. Crops that are stored in unaerated facilities should be fed or sold, or moved to aerated facilities as soon as possible.

If you would like assistance in determining the amount of airflow provided by an aeration system, you can download the FANS computer program from the website at www.bae.umn.edu/extens/harvest.html or you can order the University of Minnesota Extension bulletin Selecting Fans and Determining Airflow for Crop Drying, Cooling, and Storage, FO-5716. You can also contact an Extension office for help in determining airflow values or for additional information on crop storage management.

Iron Chlorosis: What We Know, Think We Know, And Don't Know

George Rehm, Extension Soil Scientist

In 1999, many soybean growers in the western two-thirds of Minnesota experienced substantial yield reductions caused by iron chlorosis. This problem has existed for many years. Damage is worse in some years compared to others. The damage in 1999 was especially severe.

Looking back, there have been several research projects which have focused on developing management practices to either prevent the problem or reduce the severity of the damage. None have been completely successful. There are some principles that have been learned. Yet, many questions remain. Some of the facts that we know, think we know, and

don't know about iron chlorosis are summarized in the paragraphs that follow.

We know that iron chlorosis can be a major yield-limiting factor where soybeans are grown on high pH soils that have a high organic matter content and are wet. These are general soil properties that favor iron chlorosis. We have also learned through the years that some varieties are more tolerant to iron chlorosis. Others are very susceptible. Therefore, variety selection is the first management practice that growers can use to reduce the severity of this problem. Most companies who market soybean seed have a reasonable ranking of the tolerance of various varieties to iron chlorosis.

There are no amendments or fertilizers that can be applied to the soil before planting to reduce the severity of the damage. There have been suggestions to use ammonium sulfate (21-0-0-24) and gypsum to cure the problem. Trials have been conducted to evaluate the impact of the use of these materials. Neither has been effective in reducing the reduction in yield caused by iron chlorosis. So, we know that the use of these two materials is not effective.

It appears that the severity of iron chlorosis is, in some way, linked to other stresses on the plant. For example, damage appears to be more severe where some soil factor or management practice has restricted root growth. There are several factors that could restrict root growth. These factors will not be described here. We also think that cultivation could help. In past years, farmers have reported that this is a useful practice. However, use of this management practice did not have a positive effect for many in 1999. So, the effect of cultivation has been inconsistent.

Use of foliar application of fluid iron-containing fertilizers has been successful if the plants are sprayed early (3rd trifoliate) in the growing season. Success, however, has not been consistent. Use of iron containing fertilizers applied with the seed at planting has not been carefully evaluated. So, a preliminary trial conducted in Swift County in 1999 was designed to evaluate the impact of three iron fertilizers on the yield of both a tolerant and susceptible variety. The results are listed in the following table. It is possible that the application of some iron fertilizer applied with the seed could reduce the severity of yield reduction caused by this problem.

The effect of iron fertilizers applied with the seed at planting on soybean yield.

Treatment*	Variety	
	Susceptible	Tolerant
	bu./acre	
no iron fertilizer	17.4	29.8
0-0-60 coated with iron	22.6	39.7
Iron sulfate	24.7	36.8
Iron chelate	19.8	38.1

* The rate of iron applied with all materials was 5 lb. per acre.

Although there have been many attempts to develop analytical procedures that will predict the severity of iron chlorosis, none, as yet, have proven to be effective. Several soil properties have been implicated. The percentage of free calcium carbonate as well as the soluble salt concentration are properties that are somewhat related to iron chlorosis. However, a clear and definite relationship has not been developed.

There is hope that yield reduction caused by iron chlorosis can be overcome. Research will continue in 2000. We learn a little more each year.

Trends in Food and Agriculture B -- What Does it all Mean?

Zachary Fore, Extension Cropping Systems Specialist

Numerous experts in food and agriculture met recently to discuss the changes that are and will be occurring in food a agriculture. Predicting the future is a risky business. However, understanding the past and present can give you a good idea of the direction things are going. Here are a few of the key trends that were discussed, and a little of what it may mean to farmers.

Trend #1. We are entering the era of interdependence, alliances, and partnerships.

It seems that every week we hear of a new merger, partnership, or alliance that has been formed. Even the biggest companies that have already had numerous acquisitions see the need to form alliances and partnerships to be successful. They realize that their success depends on cooperation.

What does it mean for farmers? It is critical that farmers understand the importance of interdependence. I'm not talking about sharing combines here. I'm talking about farmers working together with each other and with the food industry to meet the needs of the customer. The customer - that leads us to trend #2.

Trend #2. Those who know the customer best win.
Consumers are becoming more knowledgeable and more demanding about the food they eat. They are willing to pay more to get what they want.

What does it mean for farmers? The old system of 'produce it and they will eat it' is on the way out. Consumers and food manufacturers are demanding products of specific quality with specific traits, produced in specific ways. And, they will pay more for it.

Trend #3. Identity preserved (IP) production, driven by biotechnology, will be the rule, not the exception.
Up to now biotechnology has primarily been restricted to pesticide tolerance and pest management traits. In the future these traits will be dwarfed by traits that improve the quality and nutritional value of food. Although there are issues to be worked out, these new traits are likely to diminish the objections, especially voiced in Europe, about genetically modified organisms.

What does it mean for farmers? Farmers will absolutely need to understand and be able to implement an IP production system. Many farmers already have experience. Certified seed production and organic production are examples of IP production systems. Farmers who have not produced an IP crop should do so ASAP to gain experience with such a system. Buyers will go to farmers who know how to do it, not those that want to learn.

Trend #4. Food safety will be an immensely important issue.
There is little margin for error when it comes to food safety. Mad cow disease and a little tainted CO_2 in a soft drink are European examples of how devastating a food quality problem can be. Consumers don't request food safety, they absolutely demand it.

What does it mean for farmers? Consumers are increasingly willing to pay more for food produced using a system that they perceive results in a safer product. This creates opportunities for farmers who are willing to produce a food product in a specific way. This may involve using specific varieties, using only approved input products and practices, inspections, documentation of all activities, etc. Again, this demonstrates the importance of knowing how to produce using an IP system.

Trend #5. Access to technology and information will be key to competitiveness.
People and geographic areas that do not keep up with technological advances will be at a disadvantage. Electronic commerce and information access and dissemination will become increasingly important.

What does this mean for farmers? Our rural areas are particularly at risk of being left behind in regard to technology. Farmers need to realize that technology is an important issue for them, and they need to make their voice heard regarding technology and public policy. Farmers also need to learn how to use technology. The internet is an increasingly important tool for information access and retrieval, and commerce. GPS and yield monitors are currently important production tools that in the future may become important tools for record keeping and product certification.

Trend #6. The government safety net will catch fewer and fewer producers.
Many would say that this is not a new trend. The number of farmers has been decreasing while the size of farms has been increasing for some time now.

What does this mean for farmers? There is always debate about how much the government is or is not doing, who it should and should not help, how much it should or should not be involved in agriculture, etc. Government does have a place in agriculture, however, farmers need to spend less time and energy on what the government is or is not doing, and more time and energy on things that are in their direct control. Such as, their own production system and how they can obtain more value in the marketplace.

The bottom line is that the changes in agriculture are creating many opportunities for those that are able to work together, determine what the customer wants, and produce it according to the customer's requirements. I have no doubt that someone will be profiting from these changes. Will it be farmers? Only if they will work together, learn exactly what the customer wants, and produce it according to the customer's requirements.

Why Should Agriculture Care About Y2K?

Wayne Hansen, Redwood County Extension Educator

The clock is ticking down. Less than two months remain before the Y2K Bug strikes. Many of the Y2K problems affecting agriculture will be similar to what other business face. Others will be unique to the industry. Everyone immediately thinks about office equipment and the computers and software where dates are used. There are numerous other applications, which could be affected. Livestock farms are at more risk than crop farms.

On-Site Problems

Embedded computer chips pose one of the major Y2K risks to farmers and to agri-business. That's because we find computer chips in virtually every part of the business. If a Real Time Clock

(RTC) is present in an embedded chip, there could be a problem even if the clock is not being used. If an older Personal Computer, which is not Y2K ready, is controlling the equipment, there could also be problems related to it.

Electronic scales pose a major potential problem. Several models of truck scales have been identified as not being Y2K ready, as well as different types of other scales.

Some of the highly sophisticated grain drying equipment and crop storage ventilation systems uses microprocesser-based controls. Most of these are in grain elevators and other commercial businesses. Very few on-farm systems contain these systems. Many grain legs contain PLCs, which monitor for overheating. Microprocessors are also used in: moisture testers; feed mixing equipment; confinement barn ventilation systems; security systems; alarm systems for fire, smoke, and heat; and electrical load controllers from the electric utility.

Cars, trucks, and tractors with factory equipment should not have problems. There may be some problems with some of the add-on equipment. On-board computer systems & GPS used for Precision Agriculture should be checked well in advance before using it next spring.

If something contains microprocessors, ask the dealer or manufacturer about its Y2K readiness. Have a back up plan in case of malfunction or shortages.

Off-Site Problems: In addition to possible problems with their own equipment, farmers may experience disruptions in the supplies of electricity, feed, fuel, equipment repairs, and veterinary supplies, and deliveries to processors. Farms should have a reasonable supply of fuels, feed and supplies on-hand for potential problem dates. Waiting until the final hour to order could cause spot shortages.

Electrical utilities do not think there will be widespread blackouts, but they do suggest that there may be localized brownouts with reduced power. Farms with high-demand motors or using load controllers could experience problems. Farms needing a continuous electrical supply (confinement barns with electrical ventilation equipment, automated feeding systems, or milking systems) should have electrical generators.

Both the suppliers and purchasers of agricultural products may have problems. This could cause disruptions in the markets and supply chain.

Contingency Plans: Every livestock farm and agri-business needs a contingency or a back-up plan. "What will I do in case of a certain problem or unexpected change?" Determine where you will most likely have problems. Concentrate on areas critical to your operation first.

Plans should be made to identify and correct potential on-site equipment problems. Also plan for alternative feed sources and delays in marketing. Contact buyers, processors, and suppliers for information on their Y2K readiness. Remember, even if they think that they are ready, there still exists the remote possibility of a "domino effect" caused by problems elsewhere in the chain.

Refer to University of Minnesota Extension Fact Sheets *'A Farmer's Guide to Y2K'* and *'Farmer's Y2K Planning Checklist'* for more information and a guideline to developing a Y2K plan. Visit the University of Minnesota Extension Y2K site at: http://www3.extension.umn.edu/projects/y2k/index.html for additional information and links to other sites. Many manufacturers have information about the Y2K readiness of their products posted on their company web sites.

Conclusions: Treat Y2K like any other unplanned event. Develop a contingency plan for all types of emergencies or unforeseen problems. Be prepared, but don't panic. Panic and hoarding may cause more problems than the actual effects of Y2K. Don't purchase more inventories than reasonable. Don't wait until the last minute to order supplies or to correct equipment with possible Y2K readiness problems.

Forage Program Reminder

Terry Salmela, Kanabec County Extension Educator

Minnesota Forage Conference - January 11-12, 2000
Forage Crop Advisor Workshop - January 11, 2000
Grand Casino Conference Center, Hinckley, MN

The 25th Annual Minnesota Forage conference and Trade Show will be held January 11-12, at the Grand Casino, Hinckley. A trade show will run in the evening from 6-10 p.m.; an educational program entitled, "Pasture Management Tips for Small and Large Acres" will run from 7:30-9:00 p.m. More educational programs will run from all day on January 12. The registration fee is $25.00 for members and $55 for non-members. Contact the Minnesota Forage and Grassland Council office at 651-436-3930 for more registration details.

Crop advisors are invited to attend the Forage Crop Production Workshop on January 11 from 10:00 a.m. - 4:00 p.m. at the Grand Casino-Hinckley. A total of 5.0 CEU will be offered. The cost of the training is $75.00. Contact the Minnesota Forage and Grassland Council for registration information.

Plant Disease Clinic

Sandra Gould

Samples submitted to the Plant Disease Clinic in November included:

corn - cultured for storage molds, *Pratylenchus* sp. (lesion nematode)
wheat & silage - cultured for storage molds
barley - tested for loose smut
potato soil samples - *Verticillium* sp., *Pratylenchus* sp. Nematode
Sugarbeet - soil bioassay for *Aphanomyces* sp. Root rot
lilac - *Rhizoctonia* sp. Root rot
orchid - bacterial leaf spot
Lamium - *Phytophthora* sp. Root rot
poinsettia - *Pythium* sp. Root rot, chemical burn
cyclamen, N.G. impatiens and forget-me-not samples tested negative for INSV and TSWV.

Corn And Soybean Response To Strip Tillage In 1999

John Moncrief, Extension Soil Scientist-Tillage

There has been much interest in the upper Midwest in strip tillage. This is a new approach to managing crop residues to reduce erosive losses of soil and associated pollutants. The strip till system uses a special tillage tool in the fall to do tillage in a narrow strip with a knife somewhat larger than an anhydrous knife but smaller than a chisel plow shank. Fertilizer can be applied in a band 6-8 inches deep on 30 inch intervals behind each knife. There are often closing discs behind the knife which seal the knife zone and sometimes result in formation of a small ridge. The goal is to leave as much crop residue on the soil surface for erosion control but to create a tilled zone with loose soil and high nutrient levels.

In the spring the crop is planted directly over the tillage zones. This provides similar soil cover with crop residue as a no till system but the loose soil conditions associated with more intensive tillage approaches. Generally strip tillage has been successful in Iowa, Indiana, and Illinois. It has not been fully evaluated under Minnesota conditions. In an effort to evaluate this system plots have been established at the University of Minnesota Research and Outreach Centers (ROC) at Morris and Lamberton in 1999. The first year results from the Morris ROC are presented in this article. The strip till system is compared to four other tillage alternatives providing varying levels of soil cover with crop residue and tillage intensities. Description of the five tillage systems being evaluated follows.

Tillage Following:	
Corn	Soybeans
1. Moldboard plow	Chisel plow
2. Chisel plow	Spring field cultivate only
3. Ridge Till-plant and cultivate following both crops	
4. No Till-plant with fluted coulter only following both crops	
5. Strip Till-zone tillage in the row in the fall only for both crops	

Soil Cover with Crop Residue

During the establishment year the ridge till and no till plots have the same soil cover (23-30%). Soil cover in the row area is somewhat higher than desired (23-25%). Research has shown that soil cover should be less than 10% in a zone 10" wide centered over the row to minimize the reduced soil temperature effects due to residue on early growth. The strip till system resulted in 18-22% cover in the row, somewhat lower than no tillage but still higher than normally desired. Fall primary tillage with moldboard or chisel plows and spring field cultivation resulted in less than 10% soil cover.

Early Growth

Early growth of corn and soybeans is shown in table 1. Although there were large differences in soil cover in the row with residue it was not correlated with any reduction in early growth. A useful indicator for corn that reflects changes in crop development is grain moisture at harvest. There was also no difference in corn grain moisture due to tillage. In years when there is plenty of heat, differences in early growth

due to "in row" soil cover can be compensated for later in the season. This is often the case with soybeans and (as in 1999) on occasion with corn. If crop residue is not adequately cleared from the row area often times there is a reduction in plant stand from temperature stress. Tillage can also affect the quality of the seed bed in the row area reducing stands. There was no reduction in stand due to tillage with either corn or soybeans (table 3).

Table 1. Early growth and plant stand of corn and soybeans and corn grain moisture at harvest[1].

Tillage		Early Growth Corn	Early Growth Soybean	Plant Stand		Grain Moisture[1]
		-leaves/plant-		---1,000s---		--%--
Moldboard/Chisel		7.75a	4.00a	26.6a	165a	23.4a
No Till		7.63a	4.00a	26.1a	163a	23.3a
Ridge Till[2]		7.63a	3.87a	25.5a	178a	23.5a
Chisel/Fld. Cult.		7.75a	4.00a	25.2a	172a	22.8a
Strip Till no fert [3]		8.13a	3.87a	26.4a	173a	23.8a
Strip Till fert[4]	7.50a	3.75a		25.2a	161a	23.0a

[1] Averages followed by different letters in the same column are statistically different.
[2] This is the establishment year. Planted with no till planter configuration without tillage following soybeans and ridges built with cultivation.
[3] No fall fertilizer band applied with strip till unit.
[4] Fall fertilizer band (150 lbs/acre of 9-23-30) applied with strip till unit.

Grain Yields

The effect of tillage on grain yield of corn is shown in table 2. This is the net effect of soil density changes, cover with crop residue, and fertility shifts due to tillage. Although there is a 23 bushel per acre spread from the lowest to highest average yield, there was no statistically significant difference in corn yield due to tillage. There was a significant response to starter fertilizer (11 bushels per acre). Often times the response by corn to starter fertilizer is greater in reduced tillage systems. There was no interaction between tillage and starter response in this study however.

Table 2. The effect of tillage on corn yields, Morris, MN, 1999 (bushels per acre)

	Starter fertilizer[1]		
Tillage	no	yes	average
Chisel plow	188	195	191a[2]
No Till	179	185	182a
Ridge Till[3]	189	199	194a
Spring Field Cultivate	187	198	192a
Strip Till no Fall Fert[4]	188	203	195a
Strip Till Fall Fert[5]	195	215	205a
	188a	199b2	

[1]Starter fertilizer applied in the spring with the planter (18+36+18).
[2]Averages followed by different letters in the same row or column are statistically different.
[3] This is the establishment year. Planted with no till planter configuration without tillage following soybeans and ridges built with cultivation.
[4] No fall fertilizer band applied with strip till unit.
[5] Fall fertilizer band (150 lbs/acre of 9-23-30) applied with strip till unit.

The soybean yields were affected by tillage (table 3). Moldboard plowing and the strip till system with no fall fertilizer had higher yields than the other systems. Unlike corn there was no effect of starter fertilizer on soybean yields. The strip till system with fall fertilizer had much lower yields than without. Since tillage was identical there appears to be a negative affect of the fall applied fertilizer on soybeans with this system.

Table 3. The effect of tillage on soybean yields Morris, MN, 1999 (bushels per acre)

	Starter Fertilizer[1]		
Tillage	no	yes	average[2]
Moldboard Plow	62.7	62.1	62.4a
Strip Till-no fertilizer[3]	57.2	66.8	62.0a
Chisel Plow	57.9	58.5	58.2ab
No Till	56.3	54.0	55.9b
Ridge Till[4]	54.0	56.9	55.5b
Strip Till-fertilizer[5]	54.5	52.1	53.3b
	57.0a	58.8a	

[1]Starter fertilizer applied in the spring with the planter (18+36+18).
[2]Averages followed by different letters in the same row or column are statistically different.
[3]No fall fertilizer band applied with strip till unit.
[4]This is the establishment year. Planted with no till planter configuration without tillage following soybeans and ridges built with cultivation.
[5]Fall fertilizer band (150 lbs/acre of 9-23-30) applied with strip till unit.

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Summary

1. Tillage affected the soil cover with soybean residue. The strip till system had residue distribution similar to a no till approach.
2. Tillage did not affect the phenology or development of corn and soybeans in 1999.
3. There was no effect of tillage on corn yields.
4. Strip tillage without a fall fertilizer band resulted in similar soybean yields as a moldboard plow based system.
5. When a fall fertilizer band was applied with strip tillage soybean yield was reduced.
6. Planter applied starter fertilizer enhanced corn development and yield with all tillage systems.
7. Planter applied starter fertilizer did not affect soybean development or yield.
8. First year results at Morris look promising for strip tillage in Minnesota. The yield levels were high and conditions optimum. This system needs to be evaluated under more typical Minnesota conditions however.

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

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IN THIS ISSUE

19th Annual Crop Pest Management Short Course
November 22-23, 1999

Kevin Cavanaugh, University of Minnesota
Department of Agronomy and Plant Genetics

The 19th Annual Crop Pest Management Short Course will be held on November 22-23 at the Earle Brown Continuing Education Center located on the St. Paul campus. This program is designed for agricultural professionals, such as private crop consultants, agronomists, agrochemical representatives, soil conservationists, seed company sales/agronomists, and 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 22 will address several genetically modified organism topics such as seed biotechnology, identity preservation, marketing, and food labeling issues. All morning speakers are nationally known and have been invited speakers at international conferences.

Four breakout sessions will run concurrently in the afternoon of November 22. The four breakout sessions will be grouped under four headings: 1) Soybean Cyst Nematode, 2) The Changing Rural Economy: What will be its Impacts?, 3) Diagnostic Procedures for Nutrient Management, and 4) Farmland Drainage. Each of the sessions will have three to four speakers addressing topics related to the main category. Each of the four breakouts will run for two hours and will be repeated giving the audience the opportunity to attend two of the four sessions.

On November 23, concurrent sessions will cover a variety of topics such as weed resistance to herbicides, soil fertility management, soybean diseases, tillage systems, transgenic development in corn rootworm control, economic assessment of Bt corn, plus several

others related to pest management and crop production. Each of the concurrent sessions will be repeated at least two times. The November 22 part of the program will begin at 9:00 a.m. and conclude at 5:30 p.m. On Tuesday the program will run between the hours of 8:00 a.m. and 3:00 p.m. The CPM Short Course will offer CEU for Certified Crop Advisers in the following categories: 6.5 in Crop Management; 2.0 in Pest Management; 2.0 in Nutrient Management; 2.0 in Soil and Water Management. A maximum of 10.5 CEU can be earned during the two-day short course at the national level (multistate).

A brochure listing topics, speakers, and registration information has been released. To view the entire program, visit the University of Minnesota Agronomy and Plant Genetics home web page at: **http:www.agro.agri.umn.edu.** The registration fee for attending the two day program is $120 if received before November 16; $140 after November 16. One-day fees are $80 for November 22 and $70 for November 23. To receive a copy of the CPM Short Course brochure contact Tracey Benson, Extension Professional Programs, at (612) 624-3708 or 800-367-5363. Information on the program content can be obtained by contacting Kevin Cavanaugh, IPM & Ag Professional Program Coordinator at (612) 625-2778 or Ken Ostlie, IPM Coordinator, (612) 624-9272.

Ag. Crops Pesticide Applicator Recertification Workshop

Dean Herzfeld, Coordinator
MN Health, Environmental and Pesticide Safety

Attendance at a University of Minnesota Extension Service's Ag. Crops Pesticide Applicator Recertification Workshop makes currently licensed Minnesota commercial and non-commercial pesticide applicators eligible to renew their annual licenses with the Minnesota Department of Agriculture (MDA) for the following three years. The Ag. Crops workshops cover Minnesota licensing categories A: General Ground, C: Ag. Herbicides, and D: Ag. Fungicides & Insecticides. The workshops are 6 hours long.

Soils, Fertilizer and Agricultural Pesticides Short Course and Equipment Exposition with the Minnesota Crop Production Retailers Association
Attendees eligible to renew licenses with the MDA for 2000, 2001 & 2002
LAST CHANCE FOR YEAR 2000!!
Must attend both morning and afternoon sessions on December 8, 1999
Minneapolis Convention Center, Minneapolis, MN
Registration starts at 7:00 a.m.
Program starts at 7:30 a.m. - no late entry!

January 2000 Ag. Crops Recertification Workshop Series
Attendees eligible to renew licenses with the MDA for 2001, 2002 & 2003
January 4, 2000 - Holiday Inn and Willmar Conference Center, Willmar, MN
January 5, 2000 - McKinney's South Side Grill, Benson, MN
January 6, 2000 - Holiday Inn Alexandria, Alexandria, MN
January 7, 2000 - Holiday Inn Hotel and Suites, St. Cloud, MN
January 19, 2000 - Earle Brown Center, U of MN, St. Paul Campus

For registration information contact:

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University of Minnesota Extension Service
Direct Telephone: (612) 625-8215
Toll Free Telephone: 1-800-367-5363

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

Zachary Fore, Extension Cropping Systems Specialist

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 in the northern great plains is poor yield. When the most profitable operations in Northwest Minnesota are compared to least profitable

operations, yield is over 4 times more important than 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. In recent years, the biggest reason for poor yields has been excess water.

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 doing something about it. 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. Why is there not more tile drainage in these areas? Producers have a number of questions and concerns about tile drainage. Below are a few of the most common questions and concerns about tile drainage, and some responses to them.

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?' Data is very limited on yield response to tile drainage in Northern Minnesota and North Dakota. The few growers in the region who have tile drainage have generally been 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 does not remove plant available water from the soil. Clearly, the greatest benefits of tile drainage are realized in wet years--but because drainage promotes deep root development, crops 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. In most instances, tile drainage is 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!

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.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Conservation Tillage, Is it Working for You?

Conservation tillage, any residue management system that leaves at least 30% of the ground surface covered with crop residue, includes stubble mulching, ridge tilling, no-till, strip tillage and reduced tillage. These systems often improve organic matter percent in the soil, available phosphorus, available potassium, soil pH and soil water-holding capacity. They may also in the long-term prevent soil erosion and lead to overall improved soil tilth.

Q: Is organic matter important for our soils?
A: Organic matter affects water-holding capacity, nutrient exchange. density and tilth of soils. It may also affect nitrogen availability and release. Three to four percent organic matter may increase water-holding capacity in soil by 200 percent and increase nutrient exchange capacity 400-500 percent as well as allow release of nitrogen through mineralization as much as 50-55 pounds per acre per year.

Q: Is conservation tillage better on certain soils?
A: Used on droughty or erosive soils, yields can be improved with conservation tillage. However, poorly drained soils that remain wet and relatively cold in the spring perform less satisfactorily with conservation tillage.

Q: Are there other cost advantages to conservation tillage?
A: Zentner and Lindwell in Canada conducted a study that compared the use of sweeps, herbicides plus fall sweeps to using herbicides alone in a fallow situation. Labor with the sweep or herbicide and fall sweep systems were only 92% of conventional tillage and with herbicide use alone was 85%. Fuel and oil use was 100% with sweeps only; 84% with herbicides and fall sweeping; and, 77% with herbicides only.

Q: Will stubble from a previous crop affect my next crop?
A: Stubble can have an adverse effect on the next crop, especially if the SAME crop is planted again. Compare information on cropping rotations to decide what rotation is best for you in light of the rotational effects, crop pricing, national/global carry-over in the commodity and each field's ability to carry certain crops.

Q: Do some crops respond better to conservation tillage?
A: Yes. Winter wheat responds better than do spring-planted grains and other crops such as sunflowers and corn respond satisfactorily with adequate nitrogen and moisture available during the cropping season. Continued cold, wet conditions in the spring however can affect all of these crops. Small-seeded crops such as alfalfa, grass and flax perform well under no-till as long as the seed is placed in the proper environment and growing conditions. REMEMBER: Crops that require relatively warm soil conditions to germinate and require relatively long growing seasons usually respond less to no-till residue management.

Weed Control is Affected by Crop Residue Systems

The tillage system you choose this fall is an integral part of your weed control. Control of weedy vegetation can be more difficult with conservation tillage unless you plan carefully and can foresee and prevent problems. So, plan a better strategy than Hannibal. Data has indicated that weed populations increase on reduced tillage systems, but reach a plateau about the fourth year. Areas treated with a specific tillage system for a period of seven years show more need for control of annual weed populations, especially broadleaf weeds. Several annual weeds may be present in conservation-tillage systems, especially no-till systems. Lack of tillage gives the earlier germinating species a better chance to become the dominant species. In most cases, this tends to be broadleaf weeds such as Pennsylvania smartweed, ragweed and common lambsquarter. Annual broadleaf weeds, however, are usually easily controlled by herbicides. Once you have the broadleaves eliminated, annual grass weeds are usually your next dominant, problem species. Dropping out tillage also encourages increases in perennial weeds. The first perennials you may see are common dandelion, milkweed and Canada thistle. Increases in perennial broadleaf weeds are very common in corn where preplant tillage operations have been dropped. Perennial grass weeds can also invade. If the weed problems become difficult in a field, research has shown that build-up of annual weeds and some broadleaf perennials over a four-year period in no-till can be readily reversed by only one year of more conventional tillage. So, don't paint yourself into a corner with only one tillage system, unless the system is working. As tillage decreases, reliance on herbicides increases. No-

tillage relies completely on herbicides. Matching the herbicide treatment to the weed species to be controlled is very important. Application errors can therefore be more costly on reduced-tillage systems, especially no-till. Marginal application rates may not be effective for more resistant weed species. So, consider the progression and weed succession of each of your fields to determine what system or systems will work for you.

Forage Crop Advisor Workshop January 11th, 2000, and Minnesota Forage Conference January 11th and 12th, 2000 Grand Casino Conference Center, Hinckley, Minnesota

Terry Salmela, Kanabec County Extension Education

Forage crop advisors, agri-business agronomists, agency personnel, educators and anyone with an interest in forages is invited to the **Forage Crop Production Workshop** on Tuesday, January 11th from 10:00 am to 4:00 pm at the Grand Casino Conference Center in Hinckley, MN. A total of 5.0 CEUs will be available for certified crop advisors.

The program begins at 10:00 am with "How Nutrients Function in Forage Crops" by Neil Hansen, West Central Research and Outreach Center, Morris; "Soil Nutrient Management for Forage Crops" will be covered by George Rehm, University of Minnesota Extension Soils Specialist, and "Forage Growth and Regrowth" will be covered by Craig Sheaffer, University of Minnesota Forage Agronomist.

Following lunch "Phytoremediation to Reduce Nutrient and Pesticide Residues in Soil" will be covered by JoAnn Lamb, USDA-ARS; "Forages to Reduce Soil Compaction in Crop Rotations" will be presented by Neal Hansen, and "Management for High Quality Forage and Interpreting Forage Test Results will wrap up the training by Vance Owens, South Dakota State University.

The cost of the training is $75. Contact the Minnesota Forage and Grassland Council for registration information at 651-436-3930 or e-mail mfgc@tc.umn.edu

The 25th Annual Minnesota Forage Conference and Trade Show will be held for the first time in East Central Minnesota on Tuesday and Wednesday, January 11th and 12th at the Grand Casino, East of Hinckley. The conference will include an evening program on "Pasture Management Tips For Small and Large Acreages" on Tuesday evening, January 11th. This evening program will be targeted at the beginning producer, the small as well as large acreage owner and will run from 7:00 to 9:30 p.m. A trade show with commercial forage product exhibits will run from 6 to 10 p.m. that evening and all day on the 12th.

"Forages For Large and Small Producers" will be the theme of the program on January 12th which will run from 9:00 a.m. to 4:00 p.m. The morning general session will cover Profitable and Persistent Forages for NE Minnesota; Interseeding Pastures and Hayfields; How Biotechnology Will Affect the Future of Forages and Controlling N and P Flow Through Animals, Soil and Plants.

These concurrent sessions will be held in the afternoon.

- The Hay Session will cover: Interpreting RFV and New Hay Standards, Using Weather Forecasting When Cutting Hay; Growing Dairy Quality Hay and Economics of Making vs Buying Hay.
- The Beef Session will cover: Optimizing Production From Pastures, Managing Feed to Meet Reproductive Goals; Managing Winter Feed; and Effect of Calving Season on Pasture Use and Production Costs.
- The Dairy Session will cover: What's new in Corn Silage; Managing Post-Harvest Quality of Haylage; Economics of Hay vs Haylage and Silo Stacks and Bags for Silage Storage.

Everyone is welcome and encouraged to come to this outstanding educational program being held in this part of the state for the first time.

The registration fee is $25 for members and $55 for non-members. Contact the Minnesota Forage and Grassland Council Office at 651-436-3930 for more registration details.

Farm Emergency Assistance Legislation

Kent Thiesse, Extension Educator,
University of Minnesota Extension Service/Association of Minnesota Counties

Congress has passed a $8.7 billion dollar Farm Emergency Assistance package that provides aide to farm operators to offset low grain prices, losses from natural disasters, and reduced income from livestock production. The primary form of direct payment to farmers in this legislation will be through an additional "Market Transition" (AMTA) payment for the 1999 crop year. These payments should be sent out to farm operators in a few weeks.

Main Provision of the Farm Emergency Assistance Legislation :

- Market Loss Payments totaling $5.544 billion dollars.
  - ➢ Farm Operators that are enrolled in the seven year "Market Transition Program" will receive an additional AMTA payment for the 1999 crop year that is equal to 100 percent of the 1999 AMTA payment that most producers received in either December, 1998 or January, 1999.
  - ➢ The AMTA payment rates for 1999 were :
    Corn ------ $.363 per bushel
    Wheat ---- $.637 per bushel
    Barley ---- $.240 per bushel
    Oats ------ $.030 per bushel
  - ➢ The AMTA payment formula for each crop is as follows :
    FSA Base Acres x Program Yield x .85 x Payment Rate
  - ➢ Examples :

1. 1000 Acre Corn and Soybean Farm in Southern Minnesota
   Corn Base = 500 Acres ; Program Yield = 115 Bu./A.

   500 A. x 115 Bu./A. x .85 x $.363/Bu. = $17,742
   $17,742 / 1000 crop acres = $17.74 per acre

2. 1000 Acre Corn, Soybean, and Wheat Farm in Western MN.
   Corn Base = 350 Acres ; Program Yield = 100 Bu./A.
   Wheat Base = 350 Acres ; Program Yield = 40 Bu./A.

   350 A. x 100 Bu./A. x .85 x $.363/Bu. = $10,799
   350 A. x 40 Bu./A. x .85 x $.637/Bu. = $ 7,580

   Total = $18,379

   $18,379 / 1000 crop acres = $18.38 per acre

  - ➢ Remember : No AMTA Payment on Soybeans and Oilseed Crops or for Producers not in the seven year Transition Program.

Other Provisions in the Farm Emergency Assistance Legislation :

- $475 million dollars of assistance to oilseed producers.
  - ➢ Soybean producers will receive a direct payment at a payment rate set by USDA, based on actual production.
  - ➢ Other oilseed crops, such as Canola and Sunflowers are also eligible.

- $1.2 billion dollars in Production Loss Payments.
  - ➢ These payments will be to farm operators that suffered crop losses in 1999 due to natural disasters, such as late planting, drought, floods, etc.
  - ➢ This aid will likely be targeted to areas of the U.S. with crop disasters, which should include several counties in Northwest Minnesota.
  - ➢ Calculations will likely be similar to previous Disaster Programs.

- $325 million dollars in Livestock Assistance Funding.
  - ➢ $125 million dollars will be designated to Dairy Producers.
  - ➢ USDA will determine the payment formula.

- $400 million dollars for Crop Insurance Assistance.
  - ➢ Will be used to provide premium discounts to producers that purchase Crop Insurance for the 2000 crop year.

- $56 million dollars to the Farm Service Agency for additional staffing.

- Allow USDA to make full payment of annual AMTA Payments at anytime during the fiscal year (Oct. 1st - Sept. 30th) for the 2000 - 2002 crop years.
  - ➢ This will allow producers the option of receiving their entire 2000 AMTA payment yet this Fall or waiting until after January 1st , 2000.

- Increases the Payment Limitation from $75,000 to $150,000 for Loan Deficiency Payments (LDP's) and Marketing Loan Gains (MLG's) for the 1999 crop.

- Grants USDA the authority to make available *"Commodity Certificates"* as an available option to the Commodity Credit Corporation.

- Require mandatory Livestock Price Reporting by Meat Processors.

Summary

County Farm Service Agency (FSA) Offices should have full details on the Farm Emergency Assistance Legislation very soon. It is probably best not to call the local FSA Offices until they get the final details of the legislation, as they are extremely busy with Marketing Loans and LDP's. If you have questions on the legislation, please call Kent Thiesse, U of M / AMC Extension Educator (651-224-3344).

Economics of Fertilizing Soybeans

Dave Schwartz, Extension Educator - Soybeans

Fertilizer has never been a major expense for soybean growers. Traditionally, growers would only fertilize their corn and expect soybeans, the following year, to use the carryover P and K not used by the corn crop. In some cases, a few pounds of starter fertilizer would be applied to soybean fields only because the farmer had ordered too much corn fertilizer or past soybean yields were disappointing.

Soybeans are an important cash crop for growers across the state and soil fertility needs of the crop cannot be ignored. What we know from past research is that:

1. Little yield response is observed by adding phosphorus or potassium when soil test for P and K fall in the medium to high range. By little, we mean maybe one in five years growers see a response. When P soil test values are at or above 10 ppm Bray or 8 ppm Olsen, and K soil test values at or above 100 ppm, little if any yield response will be observed by adding additional P and K. Experiment station studies have shown yields increase 5-7 bushel per acre by adding P and K when soils test in the very low range.

Growers in the Red River Valley are successfully boosting yields by adding 50-75 pounds of nitrogen. Why? Soils are cool in this part of the state and Rhizobia bacteria less plentiful. Extension Educator Nathan Johnson conducted a soybean test plot this year in Kittson County comparing seed inoculation and the addition of nitrogen. He saw a significant yield response by inoculating seed and even more by adding 70 pounds of nitrogen.

In southern Minnesota, nitrogen is not recommended for soybeans. Inoculation is recommended if soybeans have been out of the crop rotation for at least four years. The Soils Department is in the third year of a three-year study where nitrogen rates and timing are being evaluated at several sites in southern Minnesota.

In 1998, no differences were found in soybean yield, protein, or oil. Results from 1999 plots will be shared at soybean conferences later this winter.

What about micronutrients? A number of research trials over the years have evaluated several micronutrients. Researchers have not seen a response, so at this time, micronutrients are not recommended for soybean production.

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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

19th Annual Crop Pest Management Short Course
November 22-23, 1999

Kevin Cavanaugh, Department of Agronomy and Plant Genetics

The 19th Annual Crop Pest Management Short Course will be held on November 22-23 at the Earle Brown Continuing Education Center located on the St. Paul campus. This program is designed for agricultural professionals, such as private crop consultants, agronomists, agrochemical representatives, soil conservationists, seed company sales/agronomists, and 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 22, entitled "Agriculture Biotechnology: From Seed to the Global Supermarket Shelf" will address several GMO issues. The morning topics and speakers are:

1. **Seed Biotechnology: Current and Future State.** *Michael J. Muston*, Advanta, V.P.
2. **Separating GMO and NonGMO Grains at the Local Elevator.** *Bob Zelenka,* Executive Director, Minnesota Grain and Feed Association
3. **An International Perspective of Marketing GMO Grains.** *Tom Medd,* V.P. Grain Marketing, Cenex/Harvest States
4. **How will Food Biotechnology affect Labeling of Food Products?** *Sue Harlander,* V.P. Biotechnology

Development and Ag Research, Pillsbury Company

Four breakout sessions will run concurrently in the afternoon of November 22. The four breakout sessions will be grouped under four headings: 1) Soybean Cyst Nematode, 2) The Changing Rural Economy: What will be its Impacts?, 3) Diagnostic Procedures for Nutrient Management, and 4) Farmland Drainage. Each of the sessions will have three to four speakers addressing topics related to the main theme. Each of the four breakouts will run for two hours and will be repeated giving the audience the opportunity to attend two of the four sessions.

On November 23, concurrent sessions will cover a variety of topics such as weed resistance to herbicides, soil fertility management, soybean diseases, tillage systems, transgenic development in corn rootworm control, economic assessment of Bt corn, plus several others related to pest management and crop production. Each of the concurrent sessions will be repeated at least two times. The November 22 part of the program will begin at 9:00 a.m. and conclude at 5:30 p.m. On Tuesday the program will run between the hours of 8:00 a.m. and 3:00 p.m. The CPM Short Course will offer CEU for Certified Crop Advisers in the following categories: 6.5 in Crop Management; 2.0 in Pest Management; 2.0 in Nutrient Management; 2.0 in Soil and Water Management. Please note due to the scheduling of concurrent sessions, the maximum of 10.5 CEU can be earned.

A brochure listing topics, speakers, and registration information will be released soon and mailed to ag professionals in the three state area. If you do not receive a copy of the brochure you can obtain one by calling Tracey Benson, Extension Special Programs, at (612) 624-3708 or 800-367-5363. Information on the program content can be obtained by contacting Kevin Cavanaugh, IPM & Ag Professional Program Coordinator at (612) 625-2778 or Ken Ostlie, IPM Coordinator, (612) 624-9272.

The Medium Soil Test

George Rehm, Extension Soil Scientist

In many situations, the use of the term "medium" may have the same meaning as "average" for some. This is not the case when fertilizer recommendations are considered. When working with fertilizer recommendations, medium is used to describe a category of soil test values for phosphorus (P), potassium (K), and zinc (Zn). The values for these three nutrients that fall into the medium category are:

phosphorus (Bray measurement) - - 11 to 15 ppm
phosphorus (Olsen measurement)- - 8 to 11 ppm
potassium ---- - - - - - - - - - - - - 80 to 120 ppm
zinc - -- - - - - - - - - - - - - - - - - 0.51 to 0.75 ppm

The medium range can also be though of as the optimum range of soil test values. Crop producers can be very flexible in developing fertilizer application strategies when soil test values are in the medium range. When soil test values are in this range, there is a low probability that broadcast applications will increase yields. There is a higher probability of getting a yield increase when banded applications are used for both corn and small grain production. There are several options for banded placement.

In 1998, a study was started at five locations across Minnesota to evaluate fertilzier strategies that might be used when soil test values for P and/or K are in the medium range. The yield results from two locations are discussed below.

Phosphate rate and placement options are being evaluated at the Waseca location. The initial soil test values for P and K were 15 ppm and 122 ppm for phosphorus and potassium, respectively. Both values are borderline between the medium and high categories. The corn yields from several treatments are summarized in Table 1.

Table 1. Rate and placement of phosphate fertilizer for corn production. Waseca, 1999.

P_2O_5 Applied	Placement	Yield
lb/acre		bu./acre
0	-	179
60	broadcast	180
105	broadcast	187
210	broadcast	179
30	starter	173
60	starter	180

In evaluating this information, it's apparent that the application of phosphate fertilizer at this site did not have an impact on yield. All treatments received the same rate of applied N. A uniform rate of potash was applied to all treatments.

Beginning in 1998, a similar study with potash fertilization was conducted in Olmsted County. The yields are summarized in Table 2. The initial soil test for K was 86 ppm. Soil samples (0 to 6 inches) were collected from all treatments following corn harvest. These values are also summarized in Table 2. Rates of nitrogen and phosphate fertilizer were the same for all treatments.

Table 2. Rate and placement of potash fertilizer for corn production. Olmsted County, 1999.

P_2O_5 Applied	Placement	Yield	Soil Test Postassium (Fall, 1998)
lb/acre		bu./acre	ppm
0	-	213	75
36	broadcast	204	84
72	broadcast	200	90
144	broadcast	208	95
40	starter	209	85
80	starter	207	96

In 1998, the rate of potash applied either broadcast or in a starter fertilizer at planting had no significant effect on corn yield. Even though yield was approximately 200 bu./acre, there was no substantial decrease in soil test K when no potash fertilizer was applied. In addition, there was no substantial change in the soil test for K when high rates of potash were used. Apparently, for this soil, relatively high rates of potash fertilizer are needed to bring about changes in soil test K.

The yield data summarized in the two previous tables show that corn yields are at or near optimum when soil test values are in the medium range. The medium soil test range is "optimum." There is no agronomic justification for building soil tests higher than the medium range.

This study will be continued to monitor changes in soil test values and measure grain yields.

New Publications

Two new publication related to fertilizer use are available from the County Extension Offices.

These are:

- ES-SB-7443-S Impact of "ACA" on Crop Yield in the North Central Region.
- FO-7425-F Use of Banded Fertilizer for Corn Production

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

End of Season Corn Questions

Q. What really determines the severity of frost damage on corn?

A. The duration and extent of subfreezing temperatures will determine the damage received.

Q. When does tissue damage occur versus actual kill of corn tissue with a freeze?

A. 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.

Q. With a frost, will absolutely no more assimilation toward grain fill continue?

A. 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.

Q. Does timing of a frost on a corn plant affect test weight as well as yield?

A. Yes. The later the maturity of the corn crop the less affect frost has on corn yield and corn test weight.

Q. When is corn completely safe from damage from a frost?

A. Corn at physiological maturity, or black layer will not have any yield reduction from a frost.

End of Season Soybean Questions

Q. 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?

A. 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.

Q. At what temperature, will a quick kill result on soybeans?

A. Temperatures at or below 28F for any length of time will usually result in complete soybean kill.

Q. A few of my soybeans I have harvested are green. If I slowly dry down the beans, will this color disappear?

A. 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.

Q. Can I somehow look at the soybeans and estimate maturity?

A. 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.

Q. Can't I just determine the best harvest time by the color change in the soybean leaves and pods to brown?

A. 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!

Minimizing Harvest 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.

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.

Waterhemp Weed can produce a Poisonous Punch

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

The common waterhemp weed can be poisonous. On the minor side, it can cause ruminant mammals to bloat if consumed in large quantities. Also, like some grasses, waterhemp can accumulate nitrates and may poison livestock. The nitrate toxicity in cattle causes methemoglobinemia from the conversion of nitrate into nitrite in the rumen of the animal. So, nitrite is absorbed into the blood, normal blood hemoglobin with this condition is converted into methemoglobin--which can't carry oxygen to the body tissues. In severe cases, the animal dies of anoxia. Usually, this only occurs when "large" amounts are consumed from high fertility fields and under the right environmental conditions (usually a long, low light intensity period and drought conditions). These conditions (especially drought) are not usually correlated with good waterhemp growth. And, plant species and even cultivars do differ markedly in their ability to accumulate nitrate. Stage of the plant growth is also important. Most "accumulator" plants of nitrate reach a maximum nitrate value at the prebloom stage and then gradually decline with further maturation. The total quantity of nitrate is more important than the concentration in the weed, grass or forage. In dairy cattle, a Cornell study showed that the level of nitrate ingestion had to exceed 25g/45kg of body weight and at 45g/45kg there was a 50% chance the animal would die. However, it is difficult to extrapolate from experiments using graded levels of nitrate suddenly (like in a drench or solid supplement) to conditions where nitrate is

simply a component of the weed intake. Also, under conditions where the food is being ingested over lengthy periods, ruminal microorganisms apparently adapt to rather high levels of nitrate. Sheep can also show symptoms, but they seem to adapt fairly well if the nitrate concentration is increased very slowly over several weeks.

Plant Disease Clinic

Sandra Gould, Assistant Scientist

Samples submitted to the Plant Disease Clinic in Sept. included:

alfalfa---*Uromyces* sp rust
soybean---*Phytophthora* sp root rot, pod and stem blight, *Colletotrichum* sp(anthracnose)and *Phomopsis* sp
corn---*Cercospora* sp and *Kabatiella* sp leaf spot, *Colletotrichum* sp and *Fusarium* sp stalk rot
wheat & sorghum---cultured for storage molds
hay & silage---cultured for storage molds
barley---tested for loose smut
dry bean---bacterial leaf spot, *Colletotrichum* sp (anthracnose)
canola---*Colletotrichum* sp
green bean---*Xanthomonas* sp leaf spot
pepper---*Phytophthora* sp stem rot
strawberry---*Phomopsis* sp leaf spot
red & white oak---oak wilt
catalpa---*Verticillium* sp wilt
lilac---*Phytophthora* sp root rot
Viburnum---*Rhizoctonia* sp foliar blight
R. cypress---*Phytophthora* sp root rot
Achillea---Impatiens necrotic spot virus (INSV)
Campanula---*Rhizoctonia* sp root rot
Solidago---*Ascochyta* sp leaf spot and stem decay
Coreopsis---downy mildew, *Phyllosticta* sp leaf spot
Sedum---*Fusarium* dry rot, *Colletotrichum* sp
tufted hair grass---*Bipolaris* sp leaf spot
Eupatorium---INSV
daylily---*Rhizoctonia* sp and *Colletotrichum* sp petiole & leaf spot
Physostegia---alfalfa mosaic virus
E. ivy---*Phytophthora* sp root rot
Dianthus---INSV
Heliopsis---INSV

UNIVERSITY OF MINNESOTA
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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

Segregating Genetically Modified Crops

Bill Wilcke, Minnesota Extension Engineer

Starting with the fall 1999 harvest, farmers and other grain handlers need to consider segregating genetically modified crops from those that aren't genetically modified. Genetically modified crops (also called GMOs, or genetically modified organisms) are ones that have been developed using genetic engineering techniques to have special characteristics that haven't normally occurred in nature (Bt corn or Round-Up Ready soybeans for example). Some foreign and US grain and oilseed buyers are asking for segregation of GMOs and non-GMOs so that they can respond to their customers who would prefer not to buy products made from certain types of GMOs, or at least would like to have products labeled so that they have a choice about buying such products. Some buyers will not be accepting any GMOs and some might actually offer premiums for non-GMOs.

The process of segregating crops involves separate storage and handling and documentation of separation and is called "identity preservation." The idea behind identity preservation is to make sure that a crop that has a special characteristic is protected from contamination by crops that don't have that characteristic. Once mixing occurs, it is often nearly impossible to re-separate the higher-value and lower-value crops and the marketing opportunity for the higher-value crop is lost. Along with maintaining purity of the crop through careful physical separation, farmers and grain handlers should also develop a good record keeping system so that they can document the identity of the crop or prove that they have maintained the separation. The need for identity preservation is not unique to producers of non-GMOs; identity preservation is also used by producers of seed, malting barley, organic crops, and value-enhanced crops.

Identity preservation of non-GMOs is particularly tricky because in most cases, they are not visibly distinguishable from GMOs. There are tests available to detect the presence of specific types of genetic material or other compounds that are associated with that genetic material. Several companies have developed relatively quick (5 to 20 minutes) and relatively inexpensive tests that some grain elevators and other buyers will be using to check for GMO contamination in crops that are being sold as non-GMO. Here are some tips for approaching identity preservation of non-GM crops.

Develop the proper attitude. Most crop producers and grain handlers are used to producing generic commodities and to blending crops that have different quality levels or that come from different fields. Identity preservation, on the other hand, is all about meeting the needs of customers, maintaining specific quality levels, and avoiding mixing of crops. It is important for farmers and grain handlers and their employees to buy into the concept and to be vigilant about keeping records and preventing mixing. Although genetic testing will be used by some buyers to make sure that GMOs and non-GMOs have not been mixed, honesty and trust are still important factors. Violation of that trust is likely to result in loss of customer confidence, premium prices, and future marketing opportunities. In addition, positive tests for crops that are claimed not to contain GMOs could result in lawsuits and financial penalties.

Know what the buyer wants! Some buyers specify the amount of contamination that they will allow in the delivered crop and some buyers specify the steps that they require in identity preservation programs. Check with potential buyers as early in the crop production cycle as possible - preferably even before planting.

Develop a plan for segregating crops. Draw a flowchart or at least list all of the steps involved in producing a crop from seed to delivery of harvested crop and try to anticipate all of the points where the crop could become contaminated. Then develop a plan for taking action steps and documenting those action steps to reduce chances of contamination. For some crops, you are allowed to have a certain percentage of contamination in the final product. Small amounts of contamination at each step add up and can cause the final product to exceed tolerances. Here are some places where GMO contamination can occur:

- Impure seed
- Mixing of seed during planting due to mistakes or due to inadequate equipment cleaning
- Movement of pollen by wind or insects from GMO fields to non-GMO fields
- Inadequate cleaning of combines, bins, hauling vehicles, or conveyors when switching from one crop to another
- Mistakes in filling bins or hauling vehicles

Consider growing and storing non-GMO crops in separate locations. If you own or rent farms that are physically separated from one another, it would be much easier to maintain and prove crop separation if the entire non-GMO crop is grown and stored on a separate farm. This approach can also help reduce problems with pollen drift from neighboring GMO crops. Even if you don't have separate farms with separate grain handling systems, you might consider storing non-GMO crops in bins that are not tied into the grain handling and storage system that is used for your other crops. This reduces the chances for mistakes and makes it easier to document separation. If you still have some grain in storage from last year's crop, it might be worth moving some grain around to free up separate bin space for non-GMO crops.

Keep detailed records. Use names or numbers to identify each field, grain bin, and grain hauling vehicle and consider placing signs or labels on each field, bin, or vehicle. Develop a record system that is complete, but is easy for you to use and for others (crop inspectors, for example) to understand. Record planting dates, field location and size, seed identity, inputs used, harvest date, crop yield, bin number where crop is stored, date crop is delivered, and the name of the person who delivered the crop and the number of the vehicle used. Records will be useful to you in future years and they will also be helpful if there are disputes about crop purity.

Clean equipment between crops. Most farmers don't have the luxury of using separate equipment for non-GMO crops, so they need to thoroughly clean combines, trucks, grain conveyors, and bins when they switch from one crop to another. Try to design your system and select your equipment to minimize the time and effort required for cleaning. Also, if crop maturity allows, consider cleaning your equipment before harvest and then harvesting your non-GMO crops first. With this approach, you won't need to stop to clean equipment when you switch to harvesting of GMO crops, because buyers are usually not concerned about non-GMO contamination in GMO crops.

Keep an eye on custom operations. If you hire someone else to harvest, haul, dry, clean, or do anything else with your grain, make sure that they understand the concepts and importance of identity preservation. Watch to make sure that they clean their equipment and that your crop does not become contaminated. Record names, dates, amounts, and locations to document custom operations.

Keep samples. Consider taking samples of your seed, of the harvested crop, and of the delivered crop, attaching meaningful labels, and preserving the samples until you are sure that the final buyer is satisfied that the crop meets identity and quality standards.

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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 Variable Rate Fertilizer Application

George Rehm, Extension Soil Scientist
John Lamb, Extension Soil Scientist

The concept of variable rate fertilizer application has increased in popularity for many farm enterprises in Minnesota in recent years. This new technology, similar to uniform applications, must be based on an accurate soil sampling system. The accuracy of the variable application is only as good as the soil samples used.

It's obvious that a few soil cores collected and composited from an entire field are not adequate for the variable rate system. What sampling scheme is suggested? How large an area should one sample represent? Should sample collection be based on soil type or should a grid system be used? Can samples be collected throughout the growing season? What is the variability in soil test values across a field? These are a few of the many questions raised about collection of soil samples for

variable rate fertilizer application. During the 1990's intensive research has been conducted at several land grant universities with the objective of defining specific procedures to be used when soil samples are collected for variable rate fertilizer application. Some of that research has been conducted in fields of cooperating farmers in Minnesota.

Early results of the various research efforts revealed one fact that was obvious. Variability in soil test values for P and K across a field is substantial. Frequently, the variability in 4 ½ or 2 ½ acres is as large as the variability across the field. In addition, results from Iowa State show substantial variability for these two nutrients along a row as well as across rows. As expected, the highest amount of variability is usually associated with fields that have received a heavy application of manure.

In the past, many growers would sample a field routinely over several years and find wide fluctuations in soil test values. Given the variability that we now know exists, it is not surprising that there was variability over time when the sample consisted of cores collected at random across the landscape.

Results of research using an intensive sampling scheme in fields of three farmers in central Minnesota showed that there is stability of soil test values for P, K, and pH over a growing season if the samples were collected from the same location each time. These results should be welcome information for those who collect a large number of samples.

The size of the area to be sampled for variable rate fertilizer application has been the topic for considerable debate. The information gathered leads to a recommended size of about 2.5 acres per sample. This is different from the once popular use of 4.5 acres per sample.

Regardless of the size of the area sampled, cores should be collected from at least five locations within that area. With modern technology, these locations can be georeferenced. For subsequent trips, samples can then be collected from the same location(s). Based on information gathered from intensive sampling in farmers' fields and measurement of response of both corn and soybeans to applied phosphate, there is a good chance of making an incorrect recommendation if soil samples are collected from only one location in the area to be sampled. Thus point sampling is not recommended. Historical research with soil sampling techniques has shown that the probability of making an accurate fertilizer recommendation increases as the number of cores collected increases. The same principle applies for variable rate fertilizer application.

There are no definite recommendations for selecting the locations for collection of samples in a given area. Some common sense is important. For example, samples from contrasting soil series should not be composited. The cautions for collection of samples in the past also apply for sample collection for variable rate fertilizer application.

The process of sample collection as described will obviously add to the cost of sample collection. In order to keep the cost to the grower at a reasonable level, it is suggested that samples to support variable rate fertilizer application be collected once in four years for the corn/soybean rotation. Year to year changes in soil test values for P and K are small if locations are georeferenced and a fertility program based on crop response is followed. This frequency of sampling should not have a significant effect on the application of these two nutrients.

The debate for sampling with grid cells or sampling by soil type continues and has not been resolved. Look for a discussion of this question in future issues of this newsletter.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Bouncingbet is a Sure Bet for Tillage

Bouncingbet, also known as soapwort, sweet Betty or Fuller's herb, is a perennial weed found in roadsides and fence rows. Only occasionally ranging this far North, stems of the weed can grow a foot or two tall and flower from June to September. The plant reproduces by rhizomes and seeds--which usually warns of difficult control, but Bouncingbet cannot tolerate cultivation and seldom grows in fields. It was introduced here from Europe where Monks used it for a scouring cloth and to remove stains. They gave it the Latin name, *Herba fullonum*, which means Fuller's herb. It was also used as a soap substitute in Europe during the war years. A lather can be created by crushing the leaves and mixing them with water. Ancient Greeks used sweet Betty as a diuretic, blood purifier and appetizer! The seeds contain high levels of saponins and when eaten these sapogenic glycosides cause gastroenteritis in grazing animals, destroying red blood cells.

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.

Cover Cadavers with Tansy--A Weed with a Past

The common tansy weed also known as bitter buttons (from the taste and shape of the flower heads), ginger plant, parsley fern, scented fern, cheese, hindhead or hindheal has been identified as playing a role in man's existence (or non-existence) since Roman times. The Romans knew it as tenacetum (a name which can still be recognized from the modern Spanish tanaceto). It is a perennial composite which can grow over three feet tall under the right moisture conditions (it really prefers the higher rainfall in eastern Minnesota). It is easily spotted by its finely divided leaves and in summer by its small, button-shaped, yellow flowers. The root system does have rhizomes but is easily controlled by tillage. Even though the plant has an unpleasant odor, it was used for centuries as a substitute for embalming the dead! Wrapped within funeral winding sheets it discourages worms and insects. The long-lasting flowers are probably also symbolic. In fact, the first president of Harvard was buried wearing a tansy wreath and in a coffin packed with tansy. When Harvard's "God's Acre" was exhumed for relocation in 1846, the tansy still held its shape and fragrance and helped in the identification of the president's remains. The ancient Greeks and 8th century Benedictine monks used tansy medicinally as a cure for intestinal worms, fevers, digestive problems and to heal sores. Tansy is still used as a component of some

medicines for treatment of feverish colds and jaundice. Recipes have also made the weed a palatable herb, especially in puddings and omelettes, although the plant should only be used in small measures. Of note in the North, the oil distilled from the plant and mixed with Fleabane and Pennyroyal and diluted with alcohol makes a 'mosquito dope' useful to hunters and fishermen, although it is usually not as effective as commercial preparations.

If Starch is Frosting the Top of Your Kernels, You have Your Number

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!

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 exits 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)

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 de-tasseling 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 planting. 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.

Wave a Yellow-Green Flag for Full Seed Soybeans

Soybeans enter the full seed stage (R6) when some of the beans are wide enough to be equal to the pod cavity. The end of this stage will set the beans at their total pod weight and will have the plant complete all its root growth. Plant height and node number has already peaked in the previous stage. This green bean or full seed stage initiates when only one pod containing a green seed that fills the pod cavity on at least one of the top four nodes of the main stem can be found. Not only dry weight but also nutrient accumulation peaks for the whole plant at this stage. Leaf senescence and leaf drop also just begin, starting with older leaves on the lower nodes and progressing up to younger leaves. Rapid leaf yellowing will be seen right after this stage until full maturity or until all leaves fall. Varietal differences may be seen at this time as genetics determine the length of time during which dry matter accumulates in the seed. Total pod number per plant and bean number per pod is determined during this time. Older pods and seeds are less prone to abortion. Stress can still affect yield by causing smaller seeds. However, yield reduction by stress decreases as the plant matures through R6 to negligible levels in R7. Soybeans are on the home stretch! Only lodging can prematurely drop the checkered flag on seed development.

Rain, Rain Go Away, Ear Rots Stay at Bay

Continued moisture and high humidity near harvest signals the need for vigilant field scouting for ear rot diseases such as Gibberella, Fusarium and Diplodia in corn. The same pathogens that generate stalk rot, can cause ear and kernel rots. Usually, the damage is not severe nor is it extensive across geographical areas but instead great viability may exist across fields. Usually, ear and kernel rots are seen following a season where rainfall was high from silking to harvest. Also, certain hybrids may be more susceptible to rots by genetic susceptibility or due to physical attributes such as tight husks that retain water around the ear or damaged ears (from mechanical, insect or hail injury). Rots may reduce yield and shelling percentage and may produce toxins detrimental to animal and human health, resulting in dockage at the elevator. Only timely harvest can prevent rots from spreading throughout infected ears.

Other Ear and Kernel Rots Limited, But Scout

Other fungi besides Diplodia or Gibberella can cause ear rots in corn during late season humidity. Most are more prevalent on insect, bird or hail damaged ears. Some problem fungi include: fusarium, nigrospora, gray ear, penicillium, black kernel, rhizoctonia ear rot or others. All of these ear rots are favored by extended warm-to-hot weather after silking where harvest is delayed due to wet weather. Harvest infected corn early and dry it down to 14% to stop mold growth. Consider future plantings of hybrids that have resistance to major stalk and leaf blights, which are similar pathogens.

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.

If Silage is Sought, Determine Dough

Quality silage is best cut at the medium to hard (late) dough stage. All kernels at this stage are well dented and the entire plant moisture is between 50-70% and dry matter is between 30-50% for maximum dry matter yields per unit land area. Late dough creates the best silage because well-dented kernels contain a large amount of grain as well as stalk dry matter. The entire corn plant can be used as a direct green chop feed or ensiled to be fed later. With proper harvest, storage and ensiling, silage will store well and limited mold deterioration will occur. Yield can easily be 20% less if the corn is ensiled with only half the kernels dented. Up to two-thirds of the digestible nutrients in corn silage is in the grain so corn stage at cutting is very important. Whole plant corn, either as green chop or silage, surpasses all other forage crops in dry matter yield and total digestible nutrients per unit land area.

Gibberella Guest on Ears in Cool, Wet Weather

Gibberella or red ear rot can occur with cool weather and frequent rains during ear development. Look for pinkish red mold starting at the tip end of the ear and progressing toward the butt end of the ear. Usually, only the ear tip is infected. Husks on diseased ears adhere tightly, increasing the problem with Gibberella. Many spore cycles can occur with this disease. Mechanically damaged ears including injury by hail and insects are more susceptible. Hybrids do differ in susceptibility, however detailed studies on resistance inheritance are sparse. Corn infected with Gibberella is toxic to swine. Toxins created from infected corn include vomitoxin or zearalenone which may occur in the field or in storage and are easily tested for at grain elevators for dockage. As little as 3% Gibberella-infected kernels can cause hogs to reduce consumption. Ruminants and poultry do not appear to be affected by these toxins in grain. Harvest infected corn early and dry it to 14% to stop mold growth.

Ear and Kernel Rots Differ, But Diplodia is Detrimental

Diplodia ear rots show bleached husks at the butt end of the ear where infection begins, however, complete ear rotting can occur with early infections. Damaged ears are shrunken and light-weight and usually remain upright. With time, black spores develop on the husks, cob or kernels. A white mold may also appear on the husks and between the kernels and ear shank. Similar to diplodia stalk rot, diplodia ear rot is a completely separate infection. Early season dry weather followed by frequent rain at full silking (and for 4-5 weeks afterward) promotes this ear rot. Harvest infected corn early and dry it to 14% or treat with preservatives to stop mold growth in storage. Long term, enhance control in fields by rotation, clean plowing and planting only tolerant hybrids.

Begin Maturity of Soybeans at R7

R7 stage or beginning maturity in soybeans is seen when dry matter accumulation peaks and all green color is lost. Both seeds and pods should be yellow and very little dry weight will accumulate past this time. Soybeans are about 60% moisture at R7. Any stress during this stage has no effect on yield unless hail knocks off pods or beans shatter from the pods or severe lodging of plants occurs. Unfortunately, some (very few recent public or commercial) varieties may have problems with extensive wet to dry periods nearer full maturity due to pods expanding, contracting and splitting open and dropping seed. Watch fields for crop progress. Mature pod color (browning) is not a reliable index of harvest maturity. Full maturity (stage R8) occurs when soybeans optimally may be harvested at less than 15% moisture and stored at 13% moisture.

Plant Disease Clinic

Sandra Gould, Assistant Scientist, Plant Pathology

Samples submitted to the Plant Disease Clinic in August included:

wheat: samples cultured for grain storage molds
sorghum: samples cultured for grain storage molds
soybean: *Phytophthora* sp and *Rhizoctonia* sp root rot, Brown stem rot, pod and stem blight, *Septoria* sp leaf spot, bacterial leaf spot
sugarbeet: *Aphanomyces* sp root rot
pumpkin: powdery mildew, *Phyllosticta* sp leaf spot
oak: oak wilt
birch: *Cylindrosporium* sp leaf spot
ribes: *Rhizoctonia* sp root rot
coreopsis: *Rhizoctonia* sp root rot, *Phoma* sp stem rot
poinsettia: bacterial soft rot
rose: *Cylindrocladium* sp stem rot
veronica: Impatiens necrotic spot virus (INSV)
aster: INSV
geranium: *Xanthomonas* sp bacterial wilt
ornamental grass: *Rhizoctonia* sp and *Colletotrichum* sp stem and root rot

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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

Insecticide Use for Many Crops Canceled by EPA

Bill Hutchison, Extension Entomologist

On August 2, 1999, the Environmental Protection Agency, in response to the 1996 Food Quality Protection Act (FQPA), announced major cancellations and/or modifications for two organophosphate insecticides Methyl-parathion (e.g., Penncap-M) and Azinphos-methyl (Guthion). Primary registrants include Elf Atochem (Penncap-M) and Bayer Corp. (Guthion). The cancellations apply to most food crop uses of Penncap-M; food crop labels for Guthion will be modified to allow for reduced rates, and longer pre-harvest intervals.

INSECTICIDES AFFECTED

Methyl-parathion (e.g., Penncap-M) Azinphos-methyl (Guthion)

CROPS MOST AFFECTED

Fruits and Vegetables

RATIONALE

EPA's risk assessment determined that neither insecticide, under current use patterns, would meet new safety standards necessary for FQPA. The changes are intended to reduce both dietary and worker exposure risks. The decisions also reflect a new focus of FQPA, the dietary risks to infants and children.

TIMING FOR CANCELED USES

Methyl parathion--Existing stocks of methyl parathion products (e.g., Penncap-M) with canceled crop uses may be applied until December 31, 1999. Technical

registrants of methyl parathion must amend their labels to allow reformulation only to those uses being maintained; they must repackage or re-label their products to reflect only the maintained uses. Application of methyl parathion for the canceled uses will be prohibited for the 2000growing season.

Azinphos-methyl-- All risk mitigation measures will be in place for the 2000 growing season.

CROPS AFFECTED, USES CANCELED AND REMAINING

Methyl parathion--
Canceled children's food uses all fruit (apples, peaches, pears, grapes, nectarines, cherries, and plums), carrots, succulent peas, succulent beans and tomatoes.

Others canceled:
Artichoke, broccoli, brussels sprouts, cauliflower, celery, collards, kale, kohlrabi, lettuce, mustard greens, rutabagas, spinach, turnips.

Canceled Non-Food Uses:
Ornamentals, grasses grown for seed, mosquito use, and nursery stock.

USES REMAINING (in Midwest):
Alfalfa, cabbage, corn, dried beans, dried peas, oats, onions, canola, rye, soybeans, sugarbeets, sunflower, wheat, white potatoes.

Azinphos-methyl--
Canceled uses ornamental, Christmas tree, forest tree, and shade trees, to reduce exposure to affected ecosystems, AND, cotton, East of Miss. River; all use on Sugarcane

REDUCED USE on Pome Fruit:
Apples, pears and crabapples-- involve establishment of a maximum seasonal use rate and increase the time between application and harvest. Lower the tolerance for pome fruit from 2.0 ppm to 1.5 ppm now and to 1.0ppm in 2001.

Cap production of product available in the U.S. The cap is intended to revent use of other pesticides shifting to azinphos-methyl as a result of other actions, such as the cancellation of many uses of methyl parathion.

CAN FARMERS SELL PRODUCE?
Yes, to ensure transition for growers, and avoid disruption to commerce, QPA includes a provision that allows legally treated commodities to remain in domestic and international trade.

IS IT SAFE TO EAT FRUITS AND VEGETABLES?
EPA recognizes that our food is safe, "the safest and most abundant food upply in the world, ...the benefits of a diet that includes fruits and vegetables far outweigh the risks of pesticides (Carol Browner, EPA)." The current action, under FQPA, has been taken to make our food even safer. EPAs goal is to continue to reduce risks, specifically to ensure that the food supply has the extra margin of safety required by the FQPA.

ESTIMATED IMPACT in MINNESOTA?
With regard to agricultural crops, the impact should be minimal. Primary fruit and vegetable crops affected in Minnesota include apples, snap (green) beans, and peas. Of these, apples will be affected most.

Reduced rates of Guthion will still be available for apples. Fortunately, for snap beans, Capture (bifenthrin; pyrethroid insecticide) is now available to fill the gap created by the loss of Penncap-M. Penncap-M was one of only two insecticides that could be used for European corn borer control on snap beans. The other, Orthene with a 14 day PHI, has limited use, and is on the current review list by EPA. For peas, Penncap-M is not often used.

Regarding forest and tree uses use data will need to be collected to assess the impact for these industries.

Although the immediate impact may not be great in Minnesota, other states with large fruit industries will have to make significant adjustments in insect pest management programs.

The full impact for Minnesota will not be known for sometime, but change is underway. This week's action reflects the early impact of comprehensive pesticide review underway at EPA; in the next 18 months, EPA hopes to complete similar reviews of 37 additional pesticides. These include more organophosphate insecticides (e.g., Lorsban) as well as carbamate insecticides (Furadan, Carbaryl or Sevin) and several fungicides (Bravo, Dithane, Maneb and Penncozeb). The potential impact, particularly for many vegetable and fruit crops could be significant.

PIAP programs and Cooperative Extension Specialists in each state are actively involved in evaluating the current use of "at-risk" pesticides on all major commodities. This information will be summarized in the form of "Crop Profiles" that EPA will use in the decision-making process over the next 2 years. USDA and EPA are also funding more research to find alternatives to conventional pesticide use.

Growers and commodity groups concerned about current or future impacts of FQPA, can contact Jennifer Nelson or Bill Hutchison, MN Pesticide Impact Assessment Program (612-624-9292; email nelso412@tc.umn.edu; http//www3.extension.umn.edu/projects/mpiap/

OTHER REACTIONS?

As one might guess, a diversity of views quickly surfaced this past week, in response to EPAs action. Several environmental groups have argued that these changes are "too little, too late." Several Ag Commodity groups argued that these changes are too severe. For more info. on both sides of the issue, see the Headline CNN story (and related stories) http//www.cnn.com/NATURE/9908/02/pesticide.risk/

Complete information (EPA fact sheets) on the cancellations is now available at the MN PIAP www site (bookmark this sitefor future updates as well)

http//www3.extension.umn.edu/projects/mpiap/

Information can also be obtained from EPA http//www.epa.gov/pesticides/

Growers can order an FQPA Action Kit (800-572-7740; Meister Publications). (http//www.meisterpro.com/)

Temporary Grain Storage

Bill Wilcke, Extension Engineer

With a lot of 1998 grain still in storage and 1999 grain on the way, it's likely that we'll have a large demand for information on temporary grain storage again this year. In an effort to get information out to you as quickly as possible, we've created a temporary grain storage page on the University of Minnesota Biosystems and Agricultural Engineering Department's website. The address is: http://www.bae.umn.edu/extens/postharvest/tempstor.html

So far, the site includes:

- Copies of University of Minnesota articles on temporary grain storage. We'll probably add more articles as the season progresses.
- Links to relevant extension bulletins from the U of M and from other universities.
- Links to other websites that might be useful.

We plan to keep updating the website as new information becomes available. Please let us know if this site is useful and if you'd like to see other items added to it. I hope that grain prices go up soon and that we don't need to use temporary grain storage.

Winter Wheat as a Possible Alternative

Jochum Wiersma, Small Grain Specialist, Northwest Research and Outreach Center

Due to the extreme wet weather this spring, many fields in northwest Minnesota did not get planted. Especially Roseau and Pennington Counties were hit hard. As these acres have basically been summer fallowed, winter wheat may provide an alternative to be planted yet this fall. The up front costs are limited to the seed and starter fertilizer.

The biggest problems with winter wheat production in Minnesota are:

- winter kill
- drown-out due to spring flooding

North Dakota State University's Extension Bulletin #33, written by Dr. Mike Peel, explains in detail the possibilities and problems of winter wheat production in North Dakota. The bulletin is a very good resource for the production of winter wheat in northwest Minnesota as well. A copy of the bulletin can be found at your local extension office or on the Internet: (http:www.ext.nodak.edu/extpubs/plantsci/smgrains/eb33w.htm)

The most important aspects are listed below:

Winter Wheat in North Dakota & Northwest Minnesota

More efficient labor and machinery utilization and greater competition with weeds are major advantages of winter wheat. Good stands of winter wheat are especially competitive with wild oats and may reduce herbicide costs below those incurred for spring wheat.

While the vegetative characteristics of hard red winter wheat are similar to the hard red spring types, winter wheats must be exposed to near-freezing temperatures following germination to "vernalize" the plants and initiative reproductive development.

Winter wheat varieties possess varying degrees of winter hardiness. Winter hardy varieties may withstand crown depth temperatures as low as -5°F for a short time, while less winter hardy varieties will die.

Planting in Standing Stubble
Snow cover is necessary to protect dormant plants from winter kill. A minimum of 3 inches of snow cover is necessary to prevent winter kill due to low temperatures. Several methods can be used to provide snow cover. Winter Wheat can be no-till seeded directly into flax, barley, mustard, canola, crambe sunflower or other standing crop residues left to catch the snow. Seeding into wheat or durum stubble will increase the risk of some diseases, but even this practice is often preferred to seeding into clean-tilled fields for protection from cold weather. Grain stubble from no-till or chemical fallow fields should be left at least 6 inches tall to obtain the minimum snow cover required.

Preparation of Fallow and Tilled Ground
Other methods that may be used to provide some snow cover are narrowly spaced tree windbreaks, perennial grass barriers, and the use of hoe drills. Hoe drills, which permit seed placement in deep furrows and trap snow over the seed row, are highly recommended for bare fallow and stubble mulch and will improve winter survival under most conditions.

Seedbed Preparation
Planting should be done in a firm seedbed at a depth of 1½ to 2 inches. Untilled stubble fields are usually firm.

Soil Fertility
Fertilizer requirements for winter wheat are based on a soil test and yield expectations.

Phosphorus aids overwinter survival by stimulating root growth and fall tillering. The secondary root system that develops with tillering is essential for a healthy deep-rooted plant capable of withstanding stress. While important, the contribution of phosphorus to overwinter survival is secondary to varietal winter hardiness and soil temperatures at the growing point in the plant crown.

Where soil tests results indicate phosphorus is low, a broadcast, drill row, or banded application of the needed rate is recommended. Phosphorus placed with or near the seed is most efficient.

In a dry or low moisture seedbed, the combined nitrogen and potassium applied in the drill row with the seed should not exceed 10 pounds per acre. With adequate seedbed moisture, the combined drill row application of these products should not exceed 15 pounds.

Winter wheat's fall demand for nitrogen is low and does not exceed the rate that can safely be applied in the drill row at seeding time.

Winter wheat nitrogen needs can be met in early spring. Ammonium nitrate is often superior to urea for late spring applications but should not be applied in the fall because of leaching and soil movement concerns. Spring nitrogen applications should be made as soon as possible after the crop breaks dormancy but no later than fifth leaf stage.

Seeding Dates
The recommended seeding dates for winter wheat are September 10 to September 30 in the southern half and September 1 to September 15 in northern regions. Planting after the recommended dates may reduce winter survival and grain yields and also delay maturity of the crop. Planting prior to the recommended date unnecessarily depletes soil moisture reserves, increases risk of disease and may reduce winter survival.

Varieties
Plant only the most winter hardy varieties available. Of the current varieties, Roughrider, Agassiz, Seward and Elkhorn possess the best combination of winter hardiness and yield. Roughrider is early, has strong straw and is resistant to some prevalent races of stem rust. Agassiz and Seward are also resistant to stem rust but to different races than is Roughrider.

Stand Evaluation
Stands of winter wheat are often reduced by winter injury. Don't be hasty to destroy winter wheat stands. It may be mid-April or later before degree of recovery is evident.

Research from the USDA-ARS Northern Great Plains Research Center, Mandan, ND indicates that stands of about 17 plants per square foot are required to produce maximum winter wheat yields, but stands of 11 plants per square foot can still produce yields of 40 bushels per acre. If only portions of the field are severely injured, stands of five to eight plants per square foot in the damaged areas can still produce satisfactory yields. Weeds are more of a problem in thin stands and extra herbicide treatments may be required.

Weed Control
Well established winter wheat is more competitive with summer annual weeds than are spring cereal grains, so, there may be less dependence on chemical weed control. For example, annual weeds such as wild oats and green and yellow foxtail are rarely a problem in vigorous winter wheat fields.

Disease Control
Winter wheats are subject to the same diseases as spring wheats. Tan spot is more severe and begins earlier where winter wheat has been planted into wheat stubble or straw. Planting winter wheats into the standing stubble or straw of any other crop, including barley or oats, avoids this early build-up of tan spot. None of the recommended varieties are resistant to tan spot. Fungicides can be used to help control tan spot.

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

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!

Corn on Time Should be Showing Yellow
Corn should now be rapidly developing past the blister stage and into the milk stage. The milk stage or R3 stage in corn development occurs about 18 to 22 days after silking. By looking at the ear, you can now see that the earlier blister-like kernels are just showing some yellow color on the outside and a milky-white starch accumulation inside the kernels. Most kernels have now grown from the cob materials and have a grain moisture of about 80%. Growth will be from cell expansion and further starch accumulation. Although stress at R3 is not as detrimental as it was at R1 (silking), stress can affect final grain yield by still influencing the total number of kernels which develop (especially the final kernels at the tip of the ear) and the final size and weight of the kernels. Adequate moisture, overall plant health and growth conditions will help determine ultimate corn yield. In general corn disease has remained at a minimum across the Valley with only some leaf disease affecting the crop. Insect damage has also been limited with European corn borer numbers remaining low and few reports of corn rootworm damage to either the corn plant or ears. Examine the silks and ear tips for the beetles during scouting trips across your fields.

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. But if that doesn't happen, I hope this information is helpful in making the best of the situation.

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.

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 stablize 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.

Use Financial Survival Checklist to Limit Risk in Corn and Soybeans

Weather on corn and soybean crops still can decide the ultimate price for the season, but because huge stocks from 1998 still remain consider the following checklist developed by Purdue agricultural economist, Chris Hurt:

- Take advantage of government programs. The Loan Deficiency Payment program (LDP) and loan program protect against lower prices on 1999 crops.
- Review the LDP and loan programs at your Farm Service Agency (FSA) office. Know these programs well.
- Consider selling your stored 1998 crop now with some of the recent rallies versus storing it into the new crop.
- Think through your storage (and drying) situation for this fall. Can you store all of your crop? Do you want to store all of your crop?
- Check with your elevator manager on availability and cost of storage. Ask about basis levels, too
- Look at the large carrying charges in the futures markets for wheat and corn. Learn how to earn these carrying charges. Returns to storage can really help the financial situation this year.

- Calculate which crops may provide the highest returns for your storage: wheat, corn or soybeans.
- Develop a preliminary plan of how you will handle LDPs or the loan this year for each crop.
- Think through what price levels would cause you to change your LDP or loan plans. Determine alternatives if prices change.
- Decide whether you will do LDPs at the same time you price your grain. Those who took a modest 30 cents of soybean LDP at harvest and sold beans this summer at $3.90, netted only about $3.75 after storage costs. The loan rate for some areas such as Indiana was about $5.40 guaranteed.

Source: Ohio Ag Answers, http://www.aes.purdue/AgAnswers/1999/7-27%20Survival_Checklist.html

Curly Dock Maturity Sign of Early Fall or Moisture Stress?

Curly dock the weed commonly seen in ditches, turn-rows of fields and over-grazed pastures is showing up through the Valley as reddish-brown with maturity. This weed is a perennial that generally flowers from April through July and reproduces by both seeds and root segments. It usually only reaches a height of one-half to four feet and can produce about 160 seed per plant. The root is a taproot that is large, fleshy and often yellow in color. The flowers are green and quickly become reddish-brown as they mature. Unfortunately, this weed is known to hybridize with other members in the buckwheat family that are in the Rumex genus such as the bitter dock or broadleaf dock. However, distribution of this plant is most likely to be through birds eating the seed and distributing it elsewhere. Both waterfowl as well as songbirds eat the seeds. Historically, these weeds were used for harvest of the roots in England to manufacture a black dye. The oxalates in the plant have caused problems with livestock that feed on the weed as mortality to sheep has been documented in Australia and England. Old tales have suggested that early maturing curly dock is a sign of an early fall. However, recent dry conditions may have hastened the weed maturity this year! Be sure and consider control strategies next spring to areas where this weed is very prevalent.

Weather and Management Impact Yield

Crop rotations can increase productivity and reduce costs however, the advantages are contingent upon favorable weather and appropriate management. A study conducted from 1984 to 1995 in Nebraska looked at weather factors to determine which factors influenced the year-to-year variability of crop yields. Just as you would guess, the two most critical factors for crop yields included temperature and soil moisture. These two factors correlated strongly and consistently with yields of both corn and soybeans but was less consistent with grain sorghum yields. Yields decreased as number of dry days increased and elevated temperature during August affected yields. Corn or soybean in a four-year rotation of oat/clover-sorghum-soybean-corn were least affected by high August temperatures, showing that the rotational effect utilized the soil moisture more optimally. Grain sorghum yield more positively correlated with good, warm, preseason temperatures in April. Also, as expected on all the crops, the standard precipitation during the seven to nine months preceding planting (soil profile moisture) greatly influenced the yield of the following season's crop. Yields of all the crops in rotation were consistently higher than in continuous cropping systems, especially when lower nitrogen rates were experienced. Soil profile moisture for the months before planting should be used to decide the appropriate nitrogen rate, and more importantly whether to break the rotation cycle and take advantage of highly favorable stored moisture to plant corn or alternate to a crop more favorable to lower rainfall such as sorghum. Relative crop price, use and sale of the product, machinery requirements, needs on the farm for use of the product, and other factors that influence the crop, system and nitrogen rates must all be considered to determine profitability and long-term stability during a given year.

Less Pervasive Pest Carries a Piquant Past

Common St. Johnswort (also called amber, cammock, penny John, John's wort, grace of god, rosin rose and herb-John) is a perennial that can flower from June through August. It reproduces by runners (from the base of the stem) and seeds; however, it is usually not a serious problem here as it is most abundant on sandier soil and is easily controlled biologically by an introduced flea beetle in the Pacific Northwest where it was a serious problem. It is recognized by the oblong-ovate leaves that are perforated by many translucent, glandular dots and the branched clusters of golden yellow flowers (that show tiny black spots). It can be difficult to suppress and its crushed leaves are very odorous. When young, the sap from the plant is so acrid and blistering that grazing animals will not eat it. It has long been a plant entwined in medicine and myth. In Greek mythology, the weed often showed up due to the belief that the herb was distasteful to evil spirits and its scent would keep them away or because its yellow flowers often came into bloom around Midsummer Day, June 24, the day the great sun festivals were held. The flowers have five rounded petals and long stamens that

radiate from a five-styled pistil with the stamens tipped with tiny, golden balls of pollen that give the flower the appearance of a miniature sunburst. The flowers are heliotropic, so like sunflowers, they turn from east to west with the sun crossing the sky. The name of the plant, St. Johnswort, really developed when the church renamed the Feast of Fires (the pre-Christian summer solstice) to the Feast of St. John with the plant declared sacred to St. John, who had blessed it with healing power. The leaves of the plant were believed to bring good luck as the sap of the plant turns red on exposure to air (and was equated with the blood of St. John the Baptist). The astringent, diuretic and sedative properties of some other species in this plant family have been valued over time. However, common St. Johnswort is toxic and in animals can produce photosensitization. The photosensitizing pigment is located in the glandular dots on the leaves and petals and killed millions of sheep in the west before it was biologically controlled. Easily controlled by broadleaf herbicides or tillage, especially when controlled early, the common St. Johnswort has little use other than to mourning doves and quail that eat the seeds.

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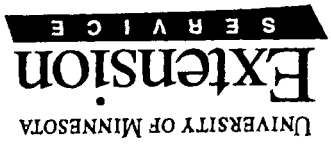

MINNESOTA

CROP NEWS

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

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In This Issue

Phosphate and Soybean Production Across a Variable Landscape

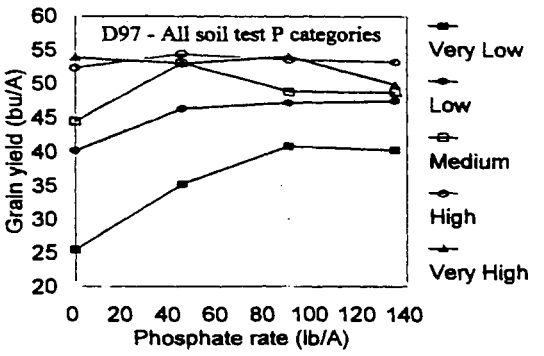
John Lamb and George Rehm, Extension Soil Scientists

Those who work with soil testing ad fertilizer recommendations realize that soil test values for any nutrient are not constant across a field or landscape. This variability becomes more evident when fields are sampled for variable rate fertilizer application. The variability of soil test values across the landscape also provides a research opportunity to gather data to improve fertilizer recommendations.

Results from a field in Faribault County in 1997 illustrate this pont. An eleven acre portion of the field was sampled intensively (60 ft. x 60 ft. grid). Various rates of phosphate fertilizer were applied on both an annual and biennial basis in a corn/soybean rotation. When broadcast on a biennial basis, the rates were 45, 90, and 135 lb. P_2O_5 per acre. In this situation, the phosphate was applied in the fall of the soybean year and incorporated with a fall chisel operation. When broadcast on an annual basis, the phosphate was broadcast and incorporated in the fall of each year. Prior to the corn year, the phosphate rates were 30, 60, and 90 lb. P_2O_5 per acre. Prior to the soybeans, the rates were 15, 30, and 45 lb P_2O_5 per acre. A control treatment (no applied phosphate) was included in both the annual and biennial applications.

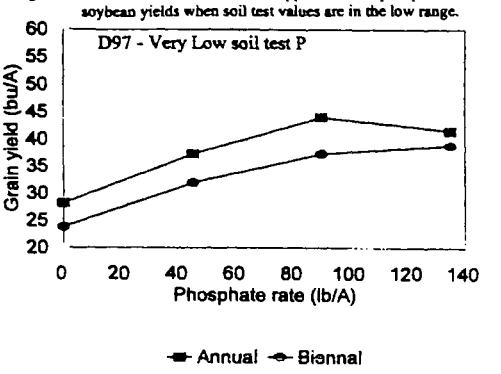
The effect of phosphate application on soybean yields at all soil test values is shown in Figure 1. The yields shown are averages for the annual and biennial applications. There was no increase in yield when soil test values were in the high (12 to 15 ppm) and very high (16+ ppm) categories. A total of 45 lb. P_2O_5 per

Figure 1. The effect of rate of applied phosphate on soybean production at various soil test values.



thereby reducing the potential for phosphorus fixation in this high pH soil.

Figure 2. Effect of annual and biennial applications of phosphate on soybean yields when soil test values are in the low range.



acre for two years was required for optimum yield when the phosphorus values were in the low (4 to 7 ppm) and very low (0 to 3 ppm) ranges. These phosphorus values are measured by the Olsen procedure.

The annual and biennial applications are compared in Figure 2. This comparison is appropriate when the phosphorus soil test values were in the low range. With each rate of phosphate applied, soybean yields were slightly higher when the phosphate was applied on an annual basis. With this frequency of application, contact between soil and fertilizer was minimized

The results of this study agree with the results of other studies where phosphate fertilization has increased soybean yields. By conducting this type of study in a field with a wide range of soil test values, it is possible to get a substantial amount of useful information in a short period of time. After considering the results from this and other locations, there is a possibility that current phosphate recommendations for soybeans will be changed.

Crop Production Tips

Denise McWilliams, NDSU/UM Crop Production Specialist

Hail on Corn Effects Estimated by Leaves

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 recently hit. 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

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.

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.

Mustards Well on their Way to Seeding

Many of the mustards that are annuals flower during the May to July period and now will be setting seed. Although several of the mustards have been used in the past such as black mustard being used as an ingredient in love potions and also for treating pneumonia (flour and ground seed of black mustard was mixed as a mustard plaster), farmers have very little love for most species in this family. In fact, black mustard can produce 13,400 seed from only one main stem! The black mustard as well as the Indian mustard and wild mustard all have an erect, branching architecture to the plants. However, blue mustard (also called purple mustard, tenella mustard and bean-podded mustard) can be either erect or can be much-branched and lower in height. This mustard has bluish-purple to pale lavender

flowers (rarely white). The fruit is in siliques (pod-like) that can break easily into unique, two-seeded sections for better seed disbursal. While many ground-foraging birds pick up and eat some of the seed, any forage tainted with the blue mustard and eaten by dairy animals can produce off-flavored milk. The blue mustard also gives off a disagreeable odor from both the leaves and stems.

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.

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.

Scout Corn for Diseases, Do Comparison Shopping for Next Year

Monitor fields for evidence of disease during each field visit. For leaf diseases, make notes on the crop stage, percent of plants affected, percent of foliage infected, whether the disease is above or below the ear and the location of the infestation within the field. Note the hybrids that look healthy and robust and look for these hybrids in other plots in order to see how they look around your area to help in determining the best hybrids for your farm next year. About four weeks after tasseling check for stalk rots in corn. Use the "squeeze test" or "push test" to determine if plants are infected. With the squeeze test, squeeze the lower internodes of the plant between your thumb and forefinger to see if tissue collapses...meaning stalk rots are present. With the push test, slightly nudge the corn stalk around the center height point and see if it breaks between the ear and lowest node...if it does, stalk rots are probably present. Test 20 plants in each of five randomly selected areas of the field to determine percent infestation. Note the fields that have more stalk rot, if any is present, as these fields will have to be harvested first, if possible.

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.

Insect Pest Updates

Bill Hutchison, Extension Entomologist

European corn borer- the 2nd generation flight is underway at our Rosemount Research and Outreach Center (Dakota Co.) in southern MN. This past week, we have been catching mostly male moths, which emerge for a few days before females (e.g., pheromone traps went over 20/night last night). Only a few females have been caught in light traps. Females started emerging this past weekend and this week; initially the flight should be low, but continued warm humid weather should be conducive to good mating and egg-lay.

Corn Earworm (CEW)- CEW pressure was extremely and unusually high this past year, from the early June flight. Typically, untreated early planted sweet corn might have 1-2% ear infestation (with CEW). This year, untreated plots ("Early V" Hybrid) at Rosemount averaged 80%. Late-instar CEW from these infestations are now exiting ears to pupate. The subsequent adults will have ample time to mate and lay eggs in August.

Of some concern, however, is that an additional 10 CEW moths were caught July 30th (Rosemount) at one of our traps adjacent to fresh-silk sweet corn. This is a high number, and indicates that they are either early moths from the local June-July larval infestation, or new moths migrating in from the southern fronts (e.g., similar weather systems bringing in PLH). Regardless of the source, we may continue to have more CEW pressure this year, than average.

In addition, look for the traditional late-August flight of CEW, which reflects the usual immigration of moths from field corn in southern states. This flight usual begins Aug. 20th, plus/minus 5 days.

Bottom Line: Sweet corn that is in the early tassel to early silk stages will likely need to receive the 1st insecticide application for adequate ear protection this week, for CEW and ECB. CEW prefers to lay eggs directly on silks, but under high-pressure will lay eggs on leaves, or on leaves near the tassel. Because many CEW eggs are laid on silks, early instar larvae move quickly from the silk into the ear tip. Thus, most insecticide control is provided by residual activity on the silks to kill larvae as they hatch, or soon after.

Bt-Sweet Corn note: Processors growing Bt sweet corn, should continue to get good to excellent control of CEW, as well as excellent control of ECB. However, Bt sweet corn should still be checked to verify CEW control.

For insecticides labeled for sweet corn and vegetable crops, see: Midwest Vegetable Production Guide '99 (BU-7094-S)(call to order: 612-625-8173) or order from Extension www site ($8.00):

http://www3.extension.umn.edu/units/dc/item.html?item=7094

With Acrobat reader, you can also access the PDF file(s) for the 1999 Guide at:
http://www.entm.purdue.edu/Entomology/ext/targets/ID/index.htm

More info. on insecticide use for sweet corn is forthcoming; see also recent message regarding new

label for Capture (now labeled for sweet corn and snap beans).

PLH- Counts remain high. In addition to continued pressure in alfalfa, other crops continue to require treatment. Snap (green) beans should continue to be checked carefully for PLH, as they continue to re-invade fields; sprays for ECB will also control PLH. Stunted plants, with "puckered" leaves are common in untreated plots. PLH thresholds for snap beans are 1/sweep or 5/row-foot, for late vegetative to early bud stage. This year, in addition to the ECB data we collect in our snap bean insecticide trials, we will also be collecting data on PLH damage and yield.

VegEdge Web site updates:
The VegEdge www page has recently been updated to make it easy to view Vegetable and Crop Newsletters from the welcome page. Drs. Dave Ragsdale and Ted Radcliffe, Department of Entomology, also recently created a new fact sheet for the Colorado Potato Beetle. These sites can be viewed at:
http://www3.extension.umn.edu/vegipm/
http://www3.extension.umn.edu/vegipm/vegpest/cpb.htm

European Corn Borer and Corn Earworm Updates

Bill Hutchison, Extension Entomologist

As noted in previous articles, the 2nd generation flight of European corn borer (ECB) is underway. As noted by Rick Weinzierl, University of Illinois, the flight is "underwhelming" at best. However, I am surprised by the high numbers of ECB male moths we are catching in pheromone traps (40/night; Rosemount, Dakota Co., MN). Female catch in light traps remains low at approx. 10/night. It will still pay to continue to watch the 2nd flight, to track the magnitude and timing of the peak of the flight, to estimate what the impact may be this year.
CEW flights at Rosemount have slowed down to about 4/night the past nights; cooler weather is slowing development and emergence of our local infestation (many still pupae and late instar larvae).

To stay in touch (i.e., by clicking a mouse) with ECB and/or CEW flights, the following www sites can be helpful.

WWW Sites to Bookmark for ECB/CEW Moth Catch Info.

1) ECB Trap Captures for MNState Map (Bugweb site, Ken Ostlie, Entomology, Minn. Extension Service)
http//www.mnipm.umn.edu/Bugweb/bugbase/flight/flightstatusmap.htm

2) or, for Bugweb, Welcome page
http//www.mnipm.umn.edu/Bugweb/

3) ECB Trap Captures in Southwestern Minnesota (updated daily; Lamberton area, Bruce Potter, Minn. Extension Service)
http//rrc2.rrcnet.org/~swes/ecblight99.htm

4) ECB and CEW Moth Catch in IL
(Vegetable Newsletter; weekly updates Rick Weinzierl, Univ of IL)
http//www.aces.uiuc.edu/~ipm/news/fvnews.html

5) ECB, CEW moth catch/updates in WI
(Karen Delahaut, Wisconsin Extension)
http//ipcm.wisc.edu/news/Update/Default.htm

6) Access to all Vegetable (+ many Field Crop) Midwestern U.S. Newsletters (VegEdge site)
http//www3.extension.umn.edu/vegipm/

Alfalfa Insect Update

Bill Hutchison, Extension Entomologist

Potato leafhopper-- populations usually start to decline in the upper midwest by mid- to late-August, for at least two reasons:

a) fewer southern weather systems bringing them our way, b) reproductive diapause of adults, in prep. for POSSIBLE return migration to the south; they become less active. Also, the adults cannot overwinter at these latitudes.

This year, however, adults may be around longer, simply because we had such a high extended egg-lay; nymphs can continue to hatch and develop from these eggs throughout August and even early September. Thus, thresholds in alfalfa and snap (green) beans may still be exceeded during the next 2-3 weeks. Treatment decisions will still be needed on a field by field basis, including the economics of the given crop (how much insecticide cost already incurred; value of the crop), time to harvest, actual injury observed, etc.

Regarding possible carryover effects in alfalfaA previous 2-year PLH study by Eric Flora, was completed in 1993 on potential carryover effects of heavy PLH damage. The study, done at Rosemount with a DeKalb variety, showed NO detrimental effects on the spring crop harvest (yield or quality), the following year. Our explanation for this, based on fall carbohydrate reserves in root tissue, was that the plants had sufficient time to recover (in Sept.) before reaching dormancy.

BLISTER BEETLES-- As if growers need one more alfalfa insect to worry about..... a few calls have come in regarding high counts in southeastern MN. Blister beetles are primarily a problem on hay grown for horse feed. Horses are very sensitive to the cantharidin toxin residing in living or dead beetles. Black and ash-gray beetles can be common in Minnesota. It is common for beetle populations to peak this time of year. Gray BB can go through 2 generations/yr; most other species only have one gen./yr.

BB larvae (in the soil, IN spring) feed on grasshopper egg pods, and can occur in high numbers, where grasshopper infestations have been high. Infestations can also become very high if the alfalfa that is allowed to go to bloom, for too long. Adults feed on pollen/nectar of flowering alfalfa, soybean, and/or weeds.

Counts of 0.5 to 1/sweep are considered a hazard if the alfalfa will be sold for horse feed. Again, this is only a guide. This warning is primarily for those producers who are actively involved with the horse market; i.e., a good rule of thumb is the more valuable the horse, the more sensitive the horse may be to the toxin. For details, get a copy of the sheet (see below).

Two insecticides that can be used Sevin XLR Plus (1 to 1.5 pts/ac) and malathion (Cythion) at 1.5-2 pts/ac, with pre-harvest intervals (PHI) of 7 and 0 days, respectively. Beetle dying from insecticide treatment will usually fall, or crawl to the ground, and not get caught in harvested hay. If insecticide is used, alfalfa should be harvested asap after treatment (and phi), to get it out of the field before it is re-infested.

A color fact sheet, "Blister Beetles in Alfalfa" can be ordered from Minn. Extension at: http//www.extension.umn.edu/DC/order.html?item=5510 or, by calling 800-876-8636 (ask for FO-5510-GO; cost $2.00).

MNCN18 (2)

Plant Disease Clinic
Sandra Gould, Assistant Scientist

Samples submitted to the Plant Disease Clinic in the last 2 weeks included:

alfalfa:	*Colletotrichum* sp on stem tissue, *Leptosphaerulina* sp leaf spot.
barley:	Barley yellow dwarf virus (BYDV)
soybean:	*Phytophthora* sp and *Rhizoctonia* sp root rot, *Septoria* sp and bacterial leaf spot.
wheat:	cultured for grain storage molds.
turf:	*Rhizoctonia* sp, *Colletotrichum* sp (anthracnose), *Drechslera* sp.
peas:	bacterial leaf spot
elm:	Dutch elm disease
oak:	Oak wilt
sedum:	bacterial soft rot, *Rhizoctonia* sp and *Colletotrichum* sp stem rot
cucumber:	bacterial leaf spot
pepper:	bacterial leaf spot (*Xanthomonas* sp)
tomato:	bacterial spot on fruit
corn:	bacterial leaf spot (Holcus), *Colletotrichum* sp (anthracnose)
hosta:	*Colletotrichum* sp petiole rot, isometric virus
Crown vetch:	*Colletotrichum* sp stem lesions
Prairie Clover:	*Uropyxis* sp rust.

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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

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

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.

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. Drought damage to soybean plants, a boron deficiency or a zinc deficiency 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.

Full Bloom on Beans Means Flower Peak

Soybeans that initiated flowering last week should be progressing into full bloom at this time. Open flowers on one of the two uppermost nodes of the soybean plant with a fully developed leaf signal the beginning of full bloom or the R2 stage. At this stage, soybeans have accumulated 25% of their total dry weight and nutrients for the season. They should also be at 50% of their final, mature height and have thus produced about 50% of their total mature node number on the plant. Rapid dry matter accumulation is proceeding, as is the use of nitrogen, phosphorus and potassium in the plant. This accumulation will continue through to full seed (R6). At R2, the nitrogen fixation rates for soybeans have increased rapidly in order to provide for the needs of the plant. Dry matter accumulation on the plant will slowly shift to pods and seeds as the plant develops and the plant canopy is complete. Plant roots have grown rapidly and the taproot and lateral root growth on R2 soybeans is already reached a depth of three to five feet, under normal weather and seasonal conditions. A 50% defoliation of the soybean plant by hail at this stage would decrease yield by 9%.

Growth Habit of Weed Leaves Farmers Frustrated

Prickly lettuce, a weed in the sunflower family, is also known as wild lettuce and commonly occurs in disturbed habitats, waste areas, roadsides, fence rows, overgrazed pastures, gardens and even cultivated fields. Having a taproot, the weed easily establishes itself. Growth early is rather low to the ground, later bolting up to a height of one and a half to up to over six feet tall. However, it does serve an early use in its life cycle. Young plants are eaten by both deer and livestock as well as having the leaves relished by wild turkeys and the sharptail grouse. As plants age, however, the forage is bitter and unpalatable although not toxic in cured hay. When full grown, the stem of the plant is erect with stiff bristles on the lower one-third of the plant. Within this lower portion of the plant is a white latex which contributes to the plant's later bitterness. The flower on the weed is a yellow with a dark blue stripe on the lower side. The seed is borne in a short achene with one seed per fruit. It can flower from July through September and reproduces by seed. Its low prostrate growth early in the season, however, allows it to often escape control although easily controlled by cultivation or broadleaf herbicides.

Potential Kernel Size Dictated by Conditions Now

With corn progressing through 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.

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. Moisture stress dictates the probability of lower yields.

Soil Water Management Clinic For CCAs

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

A clinic on several soil water management topics for certified crop advisers will be held on August 24th at the West Central Research and Outreach Center near Morris, MN. Clinic will run from 8:45 a.m. to 3 with some in-field discussions. The Minnesota Certified Crop Advisers board has granted five (5) CEUs for soil and water management credit.

Pre-registration is required by August 17th. Registration fee is $35. For a registration and program flier, contact Jean Spohr at the West Central Research and Outreach Center by e-mail spohrjm@caa.mrs.umn.edu or (320-589-1711).

Topics to be discussed will include irrigation water monitoring; fundamentals of drainage systems; soil compaction; surface runoff impacts from different field systems; and identification characteristics of wetlands. Discussions will be lead by University of Minnesota faculty from the West Central Research and Outreach Center, College of Agricultural, Food and Environmental Sciences and a research scientist from the USDA-North Central Soil Conservation Research Lab at Morris.

The workshop is being co-sponsored by the University of Minnesota West Central Research and Outreach Center and the University of Minnesota Extension Service.

Avoid Aerating Grain During Hot Weather

Bill Wilcke, Extension Engineer

Unless you detect a major grain spoilage and heating problem that is getting out of control, it is generally best not to aerate stored grain during hot weather. The primary cause of grain spoilage is

mold and insect activity. Since the optimum temperature for growth and reproduction of many types of stored grain molds and insects is 60 to 90F, operating aeration fans during 60 to 90F weather is likely to increase spoilage problems.

So how do you manage grain during hot weather? Frankly, there isn't a lot that you can do to correct spoilage problems that develop during hot weather. This means that the best grain management strategy is to take steps before hot weather arrives that will reduce the chances of spoilage. Appropriate strategies include:

- cleaning bins before harvest to remove old grain and fines that might harbor insects,
- removing broken kernels and non-grain material that from grain before storage,
- making sure that the crop is dry enough for safe storage (the warmer the temperature, the drier the grain needs to be; corn and small grains should be no wetter than 14% moisture and soybeans no wetter than 12% moisture during summer storage), and
- aerating grain during late winter or early spring - before hot weather arrives, to make sure that you have a uniform grain temperature no warmer than about 50 F.

What if you see mold growth, smell musty or sour odors, or detect grain heating during hot weather? If the problem isn't too bad and the forecast calls for cooler weather in the near future, wait until the weather changes and operate aeration fans during the coolest weather available - even if that means just running fans at night. If you have livestock and the grain isn't so moldy that it would cause animal health problems, feed the grain as soon as possible. If the spoilage problem is in an isolated spot, try to remove that spot (perhaps with a vacuum-type grain conveyor) without disturbing the rest of the grain. When you work around moldy grain, protect your lungs from mold spores by wearing respirators and familiarize yourself with potential suffocation hazards associated with collapse of bridged or caked moldy grain. If removing an isolated area of spoiled grain isn't possible, it might be best to unload the whole bin and sell it, or run it through a grain cleaner as you transfer it to another bin. If you detect grain temperatures that are greater than about 120F and are increasing, start the aeration fan to try to keep the grain cool until you can remove the grain from the bin.

Good luck in managing your stored grain. Let's hope that cooler weather arrives soon!

Seeding Year Alfalfa Stands - Potato Leafhopper Blues

Roger Becker, Extension Agronomist, Weed Science
Lisa Behnken, Extension Educator, Olmsted County
Bill Hutchison, Extension Entomologist
Craig Sheaffer, Professor, Agronomy/Plant Genetics, U of M

Leaf hopper damage has been wide spread this year. In addition to decreasing yield, severe leafhopper infestations can reduce alfalfa stands. Harvesting small grain for straw and grain can also lower seeding year alfalfa stands and yield because of the extended duration of competition from the companion crop. The worst case is where more than one of the following stresses are present: high weed populations, companion crop competition, drought stress, or leaf hopper damage; where surviving alfalfa seedling population density may range from poor to none at all. If that is the case, summer seeding of alfalfa may need to be considered to reestablish adequate stands in alfalfa crops seeded this year. On the other hand, stands may be high enough and recovery possible such that only leafhoppers management is necessary. What to do? We put our collective noggins together and came up with these thoughts.

1. Don't panic.

2. The population of potato leafhoppers has probably been high enough to kill new seeding stands this year. If you add the competition from the companion crop with the leafhopper damage, it spells trouble. In some isolated cases, disease may be playing a secondary role.

3. If your alfalfa is still under a companion crop, get the companion crop off as soon as possible - the damage is done, the stress is on - remove the competition.

4. Scout the field soon after companion crops are removed for 1) leafhopper numbers and 2) live alfalfa plants. Count the number of seedling crowns in the affected fields. You don't have to worry about number of stems, often this year all that remains is the crown with one main stem. The alfalfa plant has been under so much stress, there is very little growth, branching, etc. You should have at least 20 crowns (plants) per square foot for an adequate stand.

5. If the stand is debatable, wait as long as you dare and monitor recovery. Wait and see is part of the strategy for re-seeding. If the stand looks good enough, and leafhoppers are still present -TREAT IT. Residual insecticides, as referred to in last week's Minnesota crop news, have extended activity on leafhopper nymphs (primarily) and/or adults over time. At the time of a spray, eggs have usually already been laid in the stems; nymphs will continue to hatch for several days following insecticide treatment. The insecticide remaining on the plant surface can still be active on young nymphs as they hatch. Although new adults can continue to re-invade the field, the control of nymphs is important for minimizing development of the overall infestation, and subsequent damage to the crop.

6. If the stand is thin (less than 20 plants per square foot) - don't worry about the leafhoppers, rather re-establish the stand, either starting over or interseeding. We have plenty of moisture in many parts of the state for an August seeding. Interseeding may be all that is needed, either in patchy areas or throughout the field if partial stands remain, but are under the desired target. If stands are so poor that you need to start over completely, be sure to take out any weed flush with tillage or herbicides. If interseeding, still consider a herbicide if needed to reduce competition. Weeds or volunteer small grain can be controlled with herbicide (examples are Poast Plus, Select, or Pursuit) applied post emergence; or with clipping to remove volunteer small grain and weeds when either canopy above alfalfa seedlings. If on droughty soil where soil moisture may be limiting, consider no-till seeding to conserve moisture. No-till should also include a preplant burndown such as Roundup if significant vegetation is present at planting and the surviving alfalfa stand is not worth saving. Alleopathy should not be a problem since the stand is less than one year old.

7. We studied summer seeding using conventional or no-tillage seedbed preparation following oat harvest at Rosemount, Waseca and Morris in 1989 and 1990. Where tillage was not performed in summer seeded treatments, regrowth of weeds was very rapid following small grain harvest because annual grasses and broadleaf weeds had established root systems. Seedlings of perennial weeds such as common dandelion and volunteer small grain were common in summer seedings whether seeded with tillage or with no-tillage. Volunteer oat competition was very intense in summer seeded plots where herbicide was not used to remove volunteer oat. Morris suffered extreme winter kill in both years of study because of little snow cover and low temperatures. Yield and stand differences the following year simply reflected the degree of volunteer oat or weed competition during establishment in

summer seedings, so control any non-alfalfa competition this fall.

8. Summer seeding tips:

- Do not summer seed with a companion crop
- Risky in western Minnesota (lack of snow cover and winter kill)
- NEVER let weeds or volunteer small grains compete with a summer seeding, alfalfa seedlings need all the help they can get to establish before winter
- Seed by July 25 - August 7 in northern MN
- Seed by August 1 - August 15 southern MN

The seeding date cut off is conservative and will vary depending on the speed of alfalfa growth and establishment after seeding, when winter sets in, and when insulating snow fall occurs.

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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

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Beginning Bloom on Beans is Seen

Many soybean fields have begun to bloom through the Valley. The beginning bloom stage or R1 stage in soybeans is marked by the plants having at least one flower on any node of the main stem. Flowering, unlike maturity on soybeans, begins toward the bottom of the plant (at the third to sixth node) and then progresses upward and back downward. Branches off of the main stem will flower a few days later than the main stem. While flowering begins at the base of the plant and proceeds to the top of the plant, physiological maturity of the beans will progress in just the opposite direction. Normally, soybean pods will be mature from the top of the plant and down, thus remember to check pods toward the bottom of the plant when determining if harvest time has come. Flowering of soybeans is an important time in bean growth and development. At stage R2, full bloom, each plant has accumulated about 25% of its total dry weight and nutrients; it has attained about 50% of its mature height; and, it has produced 50% of its total mature node number. This later flowering stage begins the period of very rapid N-P-K and dry matter accumulation which will continue through R6. Also, during flowering the soybean plant gears up on its nitrogen fixation in order to provide for the demands of the plant. Keep soybean plants happy during flowering for good yields. Scout for disease and insect problems and maintain good growing conditions.

Burn, Cut, Ferment: Weed Seeds Still Survive

Weed seed have an amazing ability to survive, no matter what nature or you throw at them. Even burning fields after weed seed mature will give only erratic control. Field bindweed with 36% germination before burning can consistently still have 7% that can germinate, according to very early studies compiled by the Bureau of Reclamation (Mercer, 1940). Thus, weed species that may have been absent for many years may suddenly appear after a burn. Likewise, cutting or shredding the weeds may or may not decrease your weed seed bank on your farm unless you eliminate the weeds before the bud stage. Common sowthistle still has 100% germination of seed if the weed is cut in flower. Even Meadow barley (90%), soft brome (81%), curly dock (88%), shepherdspurse (82%)

and common chickweed (56%) seed are largely viable when the weed is cut with the seed only medium ripe. Some weed seed will even germinate after being stored in a silo for up to four years while others may lose their germinating ability in 10 to 20 days depending on silage moisture content, temperature and organic acids present. Some weed seed may even survive in manure, even during the heating and decomposition processes. Field bindweed still had 22% viability after stored in manure for two months and velvetleaf had a 2% viability after one month.

Do You Hear Your Corn Growing?

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 of good weather, corn does rapidly grow. 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. Check your fields to see how your crop is progressing and if your crop is crackling with growth!

Corn Development from V10 up to VT

Once the corn plant has 10 leaves, it has begun a steady and rapid increase in nutrient and dry matter accumulation that will continue through most of the reproductive stages. Demand for both nutrients and water remain high. At V12 up until one week before silking the number of seed per row on the corn ear will be determined. Any stresses from V12 through to physiological maturity can limit first the number (until silking) and then the fill of these kernels. Early maturing hybrids will progress through the growth stages in less time and will generally have smaller ears than more adapted or later hybrids. Right before silking, the corn plant will have the upper ear shoot development take dominance over that of any existing lower ear shoots. Moisture stress two weeks before or after silking on corn plants can cause large grain yield reductions. Stress can delay silking past pollen shed and result in missing kernels on the ear (especially on the ear tip).

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, three different stresses may be affecting the plant. Drought or heat stress could be causing the problem. Nutrient deficiency, especially boron, could be causing the lack of tassel emergence. Additionally, 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.

Production Costs: Ridge-Till Vs. Conventional

George Rehm, Extension Soil Scientist

For many years, the ridge-till planting system was thought of as a system that had advantages associated with soil conservation and fuel savings. These advantages are still appropriate for today's agriculture. There is, however, an additional advantage that can't be overlooked in today's farm economy. If costs of production for a ridge-till and conventional planting system are compared, there is a substantial savings if the ridge-till planting system is used.

The costs listed in the following tables document this difference. The costs for the ridge-till system were provided by a ridge-till farmer in north-central Iowa, and are considered to be typical of many ridge-till farmers. The machinery and repair costs for the conventional system are averages for farmers in the Iowa Farm Business Association who use conventional tillage. The typical fertilizer and herbicide costs for the conventional system were provided by a fertilizer dealer in north-central Iowa.

For this comparison, land charges are assumed to be the same for both tillage systems. Therefore, land charges are not included in these costs. Results from the MAX program in Iowa also show that yields reported by farmers using conventional tillage systems are equal to those reported by farmers who use the ridge-till system.

The ridge-till farmer in north-central Iowa used anhydrous ammonia, starter fertilizer, and banded herbicide. This use of inputs resulted in a substantial reduction in the dollars paid for these inputs.

The machinery depreciation and repair costs are calculated on an annual basis. Therefore, these costs are the same for both corn and soybean production. The reduction in herbicide costs for soybean production in the ridge-till system is due to the banded application of the herbicide.

Reported costs for corn production in a ridge-till and conventional planting system.

Item	Tillage System	
	ridge-till	conventional
	---------- $/acre ----------	
machinery depreciation	15.15	27.00
machinery repairs	13.00	32.00
dry fertilizer	24.80	43.86
anhydrous ammonia	13.30	24.40
herbicide	14.24	31.20
total:	80.40	158.46
ridge-till advantage	$78.06/acre	

Reported costs for soybean production in a ridge-till and conventional planting system.

Item	Tillage System	
	ridge-till	conventional
	---------- $/acre ----------	
machinery depreciation	15.15	27.00
machinery repairs	13.00	32.00
herbicide	9.49	18.98
total:	37.64	77.98
ridge-till advantage	$40.34/acre	

This dollar advantage, of course, will not be realized by all ridge-till farmers. Costs and returns differ for all farmers. These numbers, however, sow that costs are lower with a ridge-till system thereby opening the door for an opportunity for some profit.

With the current commodity prices and a poor outlook for improvement in the near future, the ridge-till planting system deserves a closer look. Equipment and management practices used by current-day ridge-till farmers are quite different than a few years ago. For those interested in saving money, the ridge-till system deserves a closer look.

Staples Field Day - August 12, 1999
"Making Minnesota Agriculture Competitive"
Richard A. Meronuck, Extension Plant Pathologist

If you are interested in the future of agriculture and the quality of life in Central Minnesota communities, plan now to attend this event. Animal agriculture, water quality and crop research will be among the areas of emphasis, with a mixture of field tours and speakers to address everyone's interest. Included will be educational displays and a noon chicken barbeque. Central Lakes College, the University of Minnesota and the Minnesota Department of Agriculture provide resources to the region, based out of Central Lakes Ag. Center. The day's events are sponsored through the cooperation of these partners.

The featured speaker at 1:00 p.m. will be Commissioner of Agriculture, Eugene Hugoson.

Field Tours (10:00 & 11:30)

- Corn & Soybean Population & Row Width Study - Dr. Seth Naeve, University of Minnesota
- Nitrogen Management on Edible Beans - Dr. George Rehm, University of Minnesota
- Forages for Central Minnesota Pastures - Dr. George Rehm, University of Minnesota
- Root Rot Control in Edible Beans - Dr. Richard Meronuck, University of Minnesota
- Economics of Feedlot Manure Management - Phil Nesse, University of Minnesota

Educational Seminars (10:00 & 11:30)

- Implication of Animal Agriculture on Water Quality - Dave Mulla, University of Minnesota
- What the Generic Environmental Impact Statement means to Minnesota's Animal Agriculture - Susan Schmidt, Minnesota Environmental Quality Board
- Well Monitoring Project - John Hines, Minnesota Department of Agriculture
- Cycle of Lakes - Mark Zabel, Minnesota Department of Agriculture

2:00 Legislative Overview of Manure Management - Greg Buzicky, Minnesota Department of Agriculture.

Free Water Testing Clinic

The Minnesota Department of Agriculture will be testing for nitrates in groundwater. Bring a ½ cup sample in a ziploc bag. The sample will be analyzed and results ready within 5 minutes. Minnesota Department of Agriculture personnel will be on hand to explain the results and give recommendations if your water sample shows a high nitrate level.

Central Lakes Ag. Center is located on County Road 2 and Airport Road (formerly Staples Irrigation Center). Questions, don't hesitate to call 218-894-5161.

Tilt Available for Rust Control on Dry Beans In 1999

Richard A. Meronuck, Extension Plant Pathologist

A section 18 for use of Tilt on Dry Beans was approved by EPA. The fungicide can be used through August 31, 1999. For best control on susceptible cultivar, Tilt should be applied when rust first appears on bean plants in your area. Tilt should be applied using 4 oz. Product/A. Use a minimum water volume of five gallons per acre by air and 15 gallons per acre by ground. Begin application at the first appearance of disease and continue on a 14-day schedule.

Important: 1) On certain dry bean varieties, Tilt applications may cause smaller and/or greener leaves. Yields of dry beans displaying these characteristics have not been reduced due to Tilt treatments. 2) Do not apply to succulent bean varieties or crop injury may occur.

Note: 1) Do not apply more than 12 fl oz of Tilt per season. 2) Do not make more than three applications per year. 3) Do not graze or feed forage within 7 days of application. 4) Do not harvest hay or beans within 28 days of application (harvest = cutting). 5) Do not apply Tilt to dry beans within 300 feet of any permanent lake, stream, or tributary. 6) Precautions should be taken to prevent introduction of Tilt laden sediments into aquatic habitats to decrease the likelihood of long term chronic effects on surrounding fisheries resources. Adequate measures should be taken to avoid spray drift and runoff.

Alfalfa and Potato Leafhopper (PLH)

Bill Hutchinson, Extension Entomologist
Lisa Behnken, Extension Educator

Given the continued pressure by PLH this year, and a few phone calls about specific insecticides, I am providing some additional information that may still be useful for the remainder of the season. This week, counts at the Rosemount Expt. Station (Dakota Co.) exceeded 20 PLH/sweep; yellow alfalfa has been showing up after only 7-10 days following initial infestation by adults.

Why PLH This Year? The high numbers of PLH this year can be attributed primarily to the high number of low pressure systems moving north from the Gulf Coast States this spring/summer. As each low pressure system (warm southern air moving counter-clockwise) collides with a high pressure system (clockwise) coming from the west or northwest, there is usually a rainfall event-- this facilitates the drop of new PLH from more southern states to the upper midwest. We have had a high number of these fronts meet this year over southern Minnesota. In addition, the warm weather has been conducive for good survival of nymphs, which do as much or more damage as the adult leafhoppers.

PLH injures alfalfa by repeatedly probing and feeding, with their stylets, into stem phloem tissue, injecting saliva to aid in the uptake of cell contents. Plant fluid must be drawn up the stylet before it can be tasted by leafhoppers. MECHANICAL damage from the probing activity is greatly enhanced by the flushing of cells with injected saliva. This localized activity kills phloem vascular cambium, which stimulates uneven division of new cells that eventually crush xylem elements. Thus, PLH saliva is clearly involved in aiding the digestion process of cell contents. However, the injury is due to a combination of the saliva, the probing process, and the wound response by the plant. The wound response subsequently creates the barriers to normal flow of nutrients via xylem and phloem tissue.

The most noticeable symptoms include 'hopperburn' (apical yellowing of leaves) and shortening of internodes (stunting). Initial yield losses are due to the stunting effect; by the time yellowing is noticeable, quality losses (reduced crude protein) are also underway. Typical yield losses in MN on-farm trials have ranged from 400-600 lbs/ac/cutting for established stands (2nd or 3rd cutting). Losses in a two-year new seeding study (direct-seeded) averaged 1500 lbs/ac, for 2 cuttings combined.

Control Options:

"PLH-Tolerant" Alfalfa Varieties and Economic Thresholds:

Although several advancements have been made in the past 3 years regarding alfalfa with some level of resistance to PLH, it is probably more accurate to classify these varieties as tolerant vs. resistant to PLH damage. Several field tests, and on-farm observations continue to show (at least in large-scale tests) that these varieties can tolerate considerable PLH damage, and still yield well. In a more moderate, or even "average" PLH year, selected "PLH-tolerant" varieties may yield well and save one or more insecticide applications/yr. However, in a high-pressure year such as this year (and in 1997), most of the varieties, to date, will still harbor PLH adults and/or nymphs, and may therefore still benefit from a timely insecticide treatment for PLH.

Given, the tolerance of these varieties, recent research at Iowa State Univ. found that the traditional PLH thresholds could be increased 10-fold to account for the value of this tolerance. Thus, for a typical threshold of 12/ten sweeps at the 8" height, the threshold would be 120/ten sweeps for a PLH-tolerant variety.

IF you are seeing stunting injury on a "PLH-tolerant" variety,

that you believe is due to PLH, AND the PLH counts are less than the threshold (e.g., at 50/ten sweeps), your observation reflects a difference between the response of the varieties used in the Iowa State study, and the variety in your particular field. As with most thresholds, therefore, use these as a GUIDE in making your final treatment decision. If you are seeing damage, and/or other pests such as plant bugs are also present (threshold = 3-5/sweep), then an insecticide treatment may be warranted.

Additional studies are still underway in Minnesota (Dr. Craig Sheaffer, Agronomy). When these results are available, the thresholds for PLH-tolerant varieties may undergo further revision.

The following table summarizes the standard economic thresholds (potato leafhoppers/10 sweeps), TRADITIONAL VARIETIES, which accounts for: stem height, and cost of insecticide treatment.

Table 1: Economic Thresholds (PLH per 10 sweeps) for PLH on TRADITIONAL

Alfalfa*:

Alf. Ht.(inches)	Cost of Insecticide Treatment ($)				
	10	12	14	16	18
4	2	3	4	5	6
6	3	5	6	8	9
8	4	6	8	10	12
10	5	8	10	13	15
>10	10	16	20	26	30

*For "PLH-tolerant" varieties, multiply each PLH threshold by 10.

NOTES: These PLH #s refer only to adult stage; if nymphs are also present, this is an indication of an actively reproducing infestation, with high risk of continued/future damage to the current crop. Sweep net is not very accurate as a nymph sampling tool. Use the sweep net only for adult counts; and simply note presence or absence of nymphs.

NOTES: When integrating the above information in making a treatment decision, for traditional or tolerant alfalfa, also note the degree of visible damage (i.e., initial signs of stunting as noted by shorter inter-node length, or early sign of yellowing).

NOTES: First-year seedings of the PLH-tolerant varieties should continue to be scouted and treated using conventional thresholds, due to inherent added susceptibility of young seedlings vs. older stands.

NOTES: Table 1 (Iowa State) vs. Traditional MN Thresholds: The MN thresholds provided in various publications (range from: 0.5 2.0/sweep) are in agreement for the thresholds shown in Table 1, for the 2 columns at $16-18 insecticide cost/ac. IF a grower's cost will be less than $16/ac, the thresholds will therefore be lower (takes less pest damage to cause economic loss).

Insecticides labeled for Alfalfa:
During the past few years, 2 new pyrethroid insecticides have been labeled for alfalfa, Warrior and Baythroid. The following list of products, and recommended rate ranges are shown below. The rates shown here, reflect some modifications from the label, based on previous efficacy data, or the fact that a maximum rate may have an unreasonably long pre-harvest interval
(PHI).

Table 2: Insecticides labeled for Alfalfa as of July, 1999*

Product	Rate Range (Prod/acre)	Pre-harvest Interval (Days)	
Ambush 2E**	6.4-12.8 fl oz	0-14	
Baythroid 2**	0.8-1.6 fl oz	7	
Dimethoate (Cygon) 4E	0.5-1 pt	10	(rei = 4 days)
Furadan 4F**	0.5-1 pt	7-14	
Guthion 50W Solupak	0.5-1 lb	14-16	(rei = 2 days)
Imidan 70-W	1-1.33 lb	7	
Lorsban 4E	1 pt	14	
Malathion (Cythion)5E	2 pt	0	
Penncap-M 2FM	2-3 pt	15	
Pounce 3.2EC**	4-8 fl oz.	0-14	
Sevin XRL Plus	2 pt	7	
Warrior T or 1E**	1.92-3.20 fl oz	7	(rei = 1 day)

* Always review current labels for updates or additional restrictions, e.g., many products can only be sprayed once per cutting, or per season, depending on rate used.
** Restricted Use Pesticide
Rei = re-entry interval

Table 3: Residual activity (14-days post-treatment) of several insecticides against PLH, under high PLH pressure; St. Paul, MN, 1989.

Treatment	Rate/ac	Mean # of nymphs and adults/10 sweeps (% Control) PLH-Nymphs	PLH-Adults
Cygon 4E	0.5 pt	21(90)	15(68)
Cygon 4E	1.0 pt	6(97)	8(90)
Lorsban 4E	1.0 pt	2(99)	22(73)
Lorsban 4E	1.5 pt	2(99)	20(76)
Ambush 2E	6.4 oz	29(86)	19(77)
Ambush 2E	9.6 oz	9(96)	12(85)
Penncap-M 2F	2 pt	24(89)	9(89)
Penncap-M 2F	3 pt	1(99)	11(87)
Malathion 5E	2 pt	133(38)	23(72)
Imidan WP	1 lb ai	11(95)	15(82)
Untreated-check	-------	214(-)	83(-)

The results of this study provide several insights:

- the impact of higher rates for longer residual control. for most products,
- residual impact is limited primarily to nymphs (which is still of great benefit; it is normal for adults to re-invade a field, but should still provide overall control necessary before harvest; i.e., generally only need one application/cutting)
- adults can and will continue to re-infest a field treated 14 days earlier; some adults were present within 7 days post-treatment (data not shown).
- one exception to residual control of nymphs is malathion (high rate); similar results have been obtained for Sevin; both provide good initial control but do not provide the longer residual control of nymphs, afforded by other products.

Given the pressure we continue to have this year, there is a clear need for maximum residual activity. Use the high rate of all materials for maximum activity. Both established stands and new seedings will likely need to be treated more than once this year. For established stands, sprays should still only be limited to one spray/cutting.

Sampling:

As indicated before, use a 15-inch diameter sweep net. Use pendulum sweeps, and do not sweep-sample when winds are over 10 mph. Take at least 5 sets of 10 sweeps each before tallying a final count. If numbers are variable, take up to 10 sets of 10 sweeps each. Place more emphasis on samples taken during 3-7 and 8-12 inch plant growth stages.

Where to order a Sweep Net?

Several IPM Suppliers provide sweep nets; be sure to order a net with a 15" diam. opening; those with either muslin cloth or a nylon mesh material work well (nylon mesh dries out faster). Three sources for sweepnets include: Wards-800-962-2660, Gemplers- 800-382-8473, Great Lakes IPM-517-268-5693.

The Good News? Potato leafhopper infestations USUALLY start to decline by the 3rd week of August. Therefore, it is usually the 2nd crop (after 1st cutting), and for this year the 3rd crop that are most affected.

For more information:

Hutchison, B. Alfalfa IPM: Sampling Alfalfa Insects). (FO-3516-B)
http://www.extension.umn.edu/Documents/D/C/DC3516.html#plh (to view or order)

Rice, Marlin. 1999.
http://www.ipm.iastate.edu/ipm/icm/1999/6-21-1999/potlhmang.html

Potato Leafhopper: An Unusual Threat to Soybean

Ken Ostlie, Extension Entomologist

An unprecedented immigration of potato leafhoppers this spring has set the stage for unusual damage in soybean. Older soybean has enough leaf pubescence to interfere with leafhopper movement and feeding. As a result, soybean is primarily susceptible in stages VC to V4. This year two higher risk situations have developed: soybean fields of all stages near recently cut alfalfa and late planted soybean, especially after peas. Potato leafhoppers feed with piercing, sucking mouthparts in the phloem, the internal plumbing of the plant. This feeding produces three kinds of symptoms. First, leaf tissue may die along the margins of younger leaves. Second, leaves may appear crinkled and fail to expand normally. Third, leaves may become a mottled yellow. The threshold for potato leafhopper control in soybean is as follows:

V1 - 2 Potato leafhoppers per plant
V2 – 4 Potato leafhoppers per plant
V3 – 6.5 Potato leafhoppers per plant
V4 – 9 Potato leafhoppers per plant

Potato leafhopper adults are quite mobile so fields will become reinfested eventually. Use insecticides at the low end of the labeled rate range.

Farmfest 1999 - August 3-5, 1999

Wayne Hanson, Extension Educator, Redwood County
Livestock Systems/Community Resource Development

There is something for everyone at the joint University of Minnesota Extension Service/Minnesota Department of Agriculture tent and plots at FARMFEST 99, August 3-5. The tent will once again be at the northwest corner of the exhibit grounds at the Gilfillan Estate located on Minnesota Highway 67, between Morgan and Redwood Falls.

Everyone in rural Minnesota is concerned about the farm crisis and the rural economy. "The stresses are very real once again for rural families struggling to survive with these extremely low farm prices", notes Wayne Hansen, Redwood County Extension Educator. "We will have information available on coping with stress and with economic difficulties, as well as information on other related topics such as FINPACK computer software and alternative crops."

Another potential stress affecting rural communities this year is Y2K - the Year 2000. While problems will not be as severe as some early forecasters were predicting, there will still be some problems with Y2K", says Hansen. "We will have some handouts available related to agriculture and Y2K. We think every rural family needs a contingency or back-up plan for any type of emergency, Y2K included.

Special Attractions

1. Master Gardeners will be on hand to answer plant problem questions on insects, weeds, and diseases. Bring your questions or plant specimens to get answers to your plant problems.
2. College of Agriculture, Food and Environmental Sciences will have staff from the alumni and recruitment office to answer questions about the University of Minnesota.
3. Information will be on hand explaining the joint undergraduate collaboration between Southwest State University and the Southwest Research and Outreach Center-Lamberton.
4. University President, Mark Yudof, will make a guest appearance on Tuesday, August 3, at 2:30 PM.
5. "Operation Hat Check," lead by Sheri Gahring, Extension Specialist from the Department of Design, Housing and Apparel, will discuss head protection from the sun and skin cancer. The first 150 farmers who stop by the Hat Check booth at the Extension tent each day at 1:00 PM can trade in their old caps for a free hat offering better sun protection.
6. Back for the third year, Minnesota Agrability Project. "Anyone looking for information on equipment and assistance available for farmers and agricultural workers with disabilities should be sure to stop and visit with them," says Hansen.
7. Each day there will be a Farm Forum co-sponsored by Extension in the Forum tent from 11:00 am to noon on Tuesday and Wednesday, and from 10:00 am to noon on Thursday. The Thursday forum will be televised by KTCA as part of the 4-part series of forums on the rural crisis.
8. **Free Water Testing at Farmfest**. The Minnesota Department of Agriculture will be conducting a free Nitrate Water Testing Clinic. Water samples should be kept cool until they arrive at the clinic site. A pint is all that is needed for the testing (a pint-sized ziploc bag works great). The testing clinic will be located in the Extension/MDA tent.

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Extension Plots at Farmfest Look at Decisions to Improve Farm Profits

"What crop production practices should I be doing to survive in farming in these times of low prices?" asks Wayne Hansen, Redwood County Extension Educator. Hansen says this is a common question this year in many farming communities. Farmers need to look closely at every production decision.

"Visitors to the University of Minnesota Extension Service agronomy plots at FARMFEST 99 will be able to see first-hand the results of some of these decisions," says Hansen.

There is tremendous interest in the GMOs - the genetically modified crops, according to Hansen. Most of these carry a technology fee, in addition to a possibly higher price. "Are farmers better off paying for Bt corn, or should they plant traditional corn, scout for corn borer, and spray if necessary?" asks Hansen.

There are other genetic modifications to add herbicide resistance to crops. "It started with Roundup in soybeans," Hansen noted. "Now we have Roundup Ready, Liberty Link, and imidazolinone resistant corns. The farmer needs to ask if his weed control is important enough to pay the extra fees for these seeds," says Hansen.

There are also specialty use varieties being developed. "We planted High Oil, Waxy, High Tryptophan, White, and Blue corn varieties to look at. We also have some hilum-free soybeans that are in demand by the Japanese for tofu," says Hansen. Farmers need to pay attention to yields, potential production problems, market potential and risk when deciding whether to grow these special use crops, according to Hansen.

"We also have some plots looking at white mold and SCN in soybeans and some corn fertility plots," Hansen says. "We are hoping to challenge farmers to think about various management alternatives that they should consider to improve their profitability," adds Hansen.

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Septic System Display at FarmFest

The University of Minnesota Extension Service will feature 'an inside look' at "on-site solutions for wastewater treatment" using standard treatment technologies at FARMFEST 99. The display will be set up adjacent to the joint University of Minnesota Extension Service / Minnesota Department of Agriculture tent.

Farmers and non-farm rural residents alike will be interested in the display, which will feature septic tanks, pumps, controls and 4 kinds of soil based treatment systems. The tanks and soil systems will be open for viewing to allow visitors to see baffles and effluent filters in septic tanks, examine the inside of rock, gravel-free, and chamber trenches, and view the cross-section of a mound.

With all of the interest in clean water and environmental issues, on-site sewage treatment using current and new "alternative treatment" systems are on the minds of many people.

Ken Olson, University of MN Extension Educator with the On-Site Sewage Treatment Program, asks: "Did you know

that a properly designed and operated septic system treats sewage as well as or better than any municipal treatment plant?" Olson adds, "My job is helping people understand that what we are really dealing with is the 'recycling of water' while protecting human health and the environment. Sewage treatment is first a human health issue and second an environmental issue!"

Treatment professionals from the University of Minnesota Extension Service and from industry will be on-site to answer questions and discuss current sewage treatment issues with visitors. A display in the tent will provide additional information on septic system costs, operation and maintenance.

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One display that drew a great amount of interest at last year's FARMFEST was 'Animal Mortalities Composting'. "The demonstration unit consists of a full-size prototype housed in a hoop barn constructed adjacent to our tent by the Minnesota Department of Agriculture," according to Wayne Hansen, Redwood County Extension Educator. "Last year baby pigs and feeder pigs up to 100 pounds were composted. Many visitors were skeptical about composting larger animals. This year sows up to 600 pounds were added to the composting facility." Composting has been approved for many animal species in Minnesota. "I hope livestock producers will stop by and look at this composting unit and see it working," adds Hansen. Plans and information will be available.

The MDA will also have displays with information on ongoing odor research, agricultural Best Management Practices (BMPs), loan programs, FMMAC, General Environmental Impact Study (GEIS), and other divisional programs.

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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

Crop Production Tips

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

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 auxiliary 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.

Flixweed Pest Has Numbers on Its Side

The Flixweed, a weed similar to tansy mustard, can easily be confused for the mustard except that Flixweed has glandular hairs and seeds in two rows of each half of its silique (pod). Flixweed was originally named as it was supposed to be a remedy for flux or dysentery. Flixweed is simply a corruption of "fluxweed" and in fact was found not to cure dysentery. The weed moved from Europe into Canada with the French settlers and was first introduced into North Dakota about 1910. It is an annual with an aromatic but rank odor. It can be troublesome on cultivated land, grain fields, disturbed areas, city streets, roadsides and waste places. It may overwinter as seed in the soil or as a compact rosette. It is not as competitive as wild mustard but its first flowering in North Dakota is around May 28 and flowering continues through the summer. A single plant averages 75,650 seed, but a large plant can produce 700,000 seed. The maximum seed

production from a single plant was recorded in a North Dakota soil at 704,582. Seed germination averages 70% and unfortunately can retain its viability for long periods in the soil.

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.

Scouting on Soybeans, Determine Defoliation

After trifoliolate leaves form on soybean plants, determine damage from insects or diseases or environmental 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 after defoliation 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.

When will my Soybeans be Green Again?

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 soybeans may also contribute to the stress on the soybeans 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 excess preemerge or preplant herbicide applications. Generally, yellowing quickly disappears from soybeans; however, this year the problem seems to have come early and is lingering. Apical growth on the plant should now begin to green and continue 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.

Summer Seeding For Forage Crops

George Rehm, Extension Soil Scientist

Establishment of a productive stand is a major hurdle for many forage producers. Weed control is usually a major problem for those who seed in the spring. The competition of weeds for nutrients and moisture can be substantial.

Late summer seeding is an option that may improve the probability of achieving a productive stand. For those interested in seeding forage crops this summer, it's time to start making plans. Some suggestions for summer seeding are described below.

Timing - It's important to seed early enough to allow for adequate growth of both legumes and grasses before winter starts. The amount of growth achieved in late summer and fall is directly related to the probability of the newly seeded crop surviving the winter. More fall growth equals a higher probability of survival. Seeding should be completed in early August in northern Minnesota and mid-August in southern Minnesota.

Don't Forget The Lime - A soil pH above 6.5 improves the probability of establishing forage legumes. Soil pH is not that critical for grass establishment. Apply lime, if needed, before seeding. The lime should be incorporated to a depth of 4 to 6 inches. Improved nodulation is a major benefit of lime use. The highest percentage of nodules on the roots of forage legumes is usually found in the top 6 inches of the root zone. The results of a soil test will report the amount of lime needed. Lime has little or no value if topdressed on the surface of established stands. Research has shown that lime, if needed, will improve production of many forage legumes - not just alfalfa.

Phosphate and Potash Can Be Important - An adequate, but not excessive, supply of plant nutrients in the top 6 inches of the root zone can improve the probability of a successful establishment. Broadcast the suggested rate of phohate and/or potash and incorporate before seeding. The rates needed can be determined from the results of a soil test.

A Firm Seedbed Is Essential - Forage producers who seed into a firm seedbed have a higher percentage of successful establishment. This firm seedbed prevents the planting at depths which hinder emergence. There is no logic in planting expensive seed at depths that will not assure good germination. There are various tillage implements that can be used to prepare a firm seedbed.

The probability of success with summer seeding decreases if soil moisture is not adequate. Considering the rainfall pattern of the beginning of the summer of 1999, there doesn't appear to be a very high probability of a dry seedbed this year.

Disease Update

Jochum Wiersma, Small Grains Specialist

Tan Spot and Septoria Leaf Diseases:

The conditions have been very favorable for the development of the leaf diseases. Especially tan spot can readily be found in most fields. In a few fields powdery mildew was also present.

Leaf Rust

Leaf rust can be found in many fields at low incidence and severity. In many cases, the disease is confined to the lower and middle leaves. Varieties susceptible to T-races of leaf rust show the most symptoms. The varieties known to be susceptible to the new class of leaf rust races include Pioneer 2375 and AC Barrie. Other varieties which are suspect are Forge, Oxen, Ingot and Bacup.

Fusarium Head Blight (Scab)

The first symptoms of Fusarium head blight or scab have been found in both wheat and barley. Early observations indicate that incidence and severity are low in the earliest planted wheat in the southern Red River Valley. Preliminary reports indicate higher incidences farther north.

Many of you have been checking the spore counts that are posted on the NDSU disease forecasting web site or on the toll-free number and wondered about the values posted. Dr. Leonard Francl indicated that in retrospect, the word "low" was probably a poor choice of words. First of all, the correlation of spore counts and the potential of a Fusarium head blight is poorly understood. The work Dr. Francl is currently doing is the address to that particular question. Secondly, the word "low" implies a margin of safety. Apparently the fungus and plants find each other much more readily than spore samplers.

The current weather conditions are very favorable for scab to develop. If we use the following rule of thumb:

1) above normal precipitation

2) daytime temperatures in the mid-seventies to low eighties
3) high dew points
4) a rain event five to seven days prior to flower anthesis.

Most wheat is at high risk for scab.

Loose Smut

Loose smut (*Ustillago nuda*) is a seedborne fungal disease that produces black spore masses that completely replaces the heads. Loose smut is common in many fields and in some cases severity ranges from 2 to 3%. Although there are no control options at the time the symptoms become evident, the disease can readily be controlled with any of the available seed treatment products. Therefore, if this year's crop shows more than 1% loose smut incidence and the seed will be harvested with the intention to use it as seed next year, a seed treatment for next year is recommended.

The Decision to Spray a Fungicide

The decision of a fungicide application remains the same as last year. The primary focus is control of the foliar diseases complex (tan spot and Septoria) and delaying the decision to spray to a heading application to gain suppression of scab. Under this scenario, the decision keys that were developed by Dr. Roger Jones and Dr. Marcia McMullen are very helpful. If an economic return is likely and the spray application can be delayed to the beginning of anthesis, an economic return is very likely.

The presence of leaf rust doesn't complicate this picture very much. The decision key also works for that disease as well. Both Tilt and Folicur also control leaf rust when applied at the 4 fl oz/acre rate.

Plant Disease Clinic

Sandra Gould, Assistant Scientist

Samples submitted to the Plant Disease Clinic in the last two weeks included:

alfalfa: *Cercospora* sp and *Leptosphaerulina* sp leaf spot, nutritional deficiencies.
corn: *Collectotrichum* (anthracnose) leaf spot, *Xiphinema* and *Longidorus* sp nematodes.
oat: Barley yellow dwarf virus.
wheat: Cultured for storage molds.
soybean: *Colletotrichum* sp (anthracnose), *Rhizoctonia* sp stem rot, *Phytophthora* sp root rot.
elm: Dutch elm disease
oak (red, bur & white): oak wilt.
witch-hazel: *Pythium* sp root rot.
woodbine: *Macrophoma* sp leaf spot.
strawberry: *Colletotrichum* sp (anthracnose) on fruit, *Diplocarpon* sp on leaf and calyx tissue
turf: *Rhizoctonia* sp root rot.
green bean: *Fusarium* sp and *Rhizoctonia* sp root rot.

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MINNESOTA
CROP NEWS

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

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Growth Regulators Affecting Corn

Denise McWilliams, NDSU/UM Crop Production Specialist

Cool, wet spring weather initiated stress on corn planted early in May and again affected corn planted during the cold weather in mid-May. Ample moisture in many areas has also limited root growth. From this preconditioning, corn generally has not had as extensive a root system as normally develops by the four to five-leaf stage. Additional stresses such as any soil compaction, on-off aerobic conditions in saturated soils, cool soils and temperatures, and limits on some fields to nutrients (due to nitrogen losses from rainfall and wet soil conditions and slower uptake by the plants of nutrients) have all affected corn growth and development.

Recent postemergence herbicide use has had excellent control on weeds. Higher than normal humidity and excellent growth conditions for plants have allowed lower labeled rates to work well on weeds. However, this excellent growth has also stimulated corn growth, adding one more stress on the corn plant for energy reserves.

With the current conditions, application of any growth regulator mode of activity herbicide should be carefully considered, including uses of 2,4-D, Scorpion III, Banvel, Clarity, Stinger, Distinct, Celebrity or other mixes with 2,4-D or dicamba or clopyralid. Check the fields for general plant health and determine the optimum rate of application based on need (and growth stage limitations) and environmental conditions just before, during and (if weather change is suggested in the forecast) just after application. If continued weather conditions show high humidity at the time of application and neither the weeds or crop plants are stressed, good to excellent chemical activity will occur across the field. Carefully read label instructions on additives and surfactants for application rates that are needed specifically for controlling the weeds in the field. Over application or overlaps in the field while spraying corn fields that have stressed corn plants can result in wrapped or goosenecked leaves. High winds following applications on stressed plants can have even more drastic affects on brittle stalks due to the rapid growth of the corn plants.

In this issue

Inventory Fields for Problem Management

Denise McWilliams, NDSU/UM Crop Production Specialist

Cool, wet spring weather requires additional crop scouting on fields that have been planted throughout the summer. One way to keep track of fields and problem areas is to map the field and to include with this map a field observation sheet of factors affecting crop growth. On the map, write in the year, crop, date, and stage of the crop with each observation. List any unusual (good or bad) crop conditions during each scouting review. Make a note of the hybrids or varieties most affected. Diagram the unusual or problem areas on the field map. Next, use the following check list with your map to further document your crop nonperformance by checking off the probable causes of problems in the field:

1. Climatic Influences

- ❑ temperature
- ❑ lack of light
- ❑ wind-whipping
- ❑ drought
- ❑ flooding
- ❑ freeze damage
- ❑ frost injury
- ❑ other? _____

2. Soil Influences

- ❑ high clay areas prone to flooding
- ❑ sandy areas prone to drought stresses
- ❑ high pH
- ❑ low pH
- ❑ organic matter differences in the field
- ❑ compaction
- ❑ root growth impedance (rocks, compaction, etc.)
- ❑ crop residue acting like high organic matter
- ❑ other? _____

3. Geographical Influences

- ❑ steep land
- ❑ low area (flooding, frosting, freezing)
- ❑ high area (drought, freeze, frost, wind damage)
- ❑ altitude
- ❑ maturity range not suited for the location (too early or too late a variety planted)
- ❑ erosion problems (water, soil)
- ❑ other? _____

4. Pest Influences

- ❑ disease (symptoms, suspected disease)
- ❑ nematode damage
- ❑ weed competition (weed appearance or mix, specific species)
- ❑ insect damage (symptoms, species)
- ❑ lodging (and suspected reason)
- ❑ bird/animal damage
- ❑ other? _____

5. Chemical Influences

- ❑ herbicide injury (what was used; rate; resulting damage; probable cause overlapping applications, over application, miscalibration, synergistic effect of chemical mixture)
- ❑ insecticide injury
- ❑ commercial fertilizer (plant burn, plant stress, salting)
- ❑ manure (plant burn, plant stress, salting)
- ❑ stand/density loss due to chemical (what chemical, why?)
- ❑ lodging of crop plants from chemical application (what chemical, why?)
- ❑ residue decomposition affecting the present crop (allelopathy, decomposition tie-up)
- ❑ other? _____

6. Physical Damage or Tillage or Planting Influences

- ❑ mechanical damage (cultivator blight?)
- ❑ stand or density problems (too thin a stand; too thick a stand, other cause of planter calibration or operator misjudgement?)
- ❑ fertilization injection applied too late (root/plant pruning from late application)
- ❑ lodging (suspected reason?)
- ❑ tassel or flower drop (why?)
- ❑ ear or pod drop (why?)
- ❑ kernel, soybean or plant loss (physical damage cause?)
- ❑ compaction due to equipment, tillage or other
- ❑ root growth impedance due to physical damage
- ❑ seeding impedance from heavy residue, planter depth not set correctly, planter not heavy enough to cut through soil or residue properly
- ❑ other? _____

Was Your Corn Knee-high by the Fourth of July?

Denise McWilliams, NDSU/UM Crop Production Specialist

Early planted corn should be ahead of the expected growth for the season this year. Corn planted within the first week of May that has not had any replanting problems should be looking good and well above knee-high. Low insect pressure in corn has helped preserve crop health (even on late-planted and replanted fields) and reports from the Midwest suggest low levels of corn borer.

From germination to the four-leaf stage, corn normally is at risk from sod webworms, slugs, stalk borers, true armyworms, billbugs, flea beetles, and corn root aphids on the plant with wireworms, white grubs, black cutworms, seed corn beetles, and seed corn maggots still having the potential for a go at the root of the seedlings. Once into corn's fifth-leaf stage, the insects to watch for through silking include European corn borer, corn rootworm, true armyworm, and fall army worm with some potential damage from stalk borer, sod webworm, black cutworm, white grub, and wireworm (if numbers increase beyond what we have seen during spring).

Besides insects, other reasons to carefully monitor your corn fields from knee-high to tasseling include:

- Any severe wilting or death of plants may be due to lightning (usually a circular pattern in the field), or with dieback of the leaves (wilting, drying up of leaf tissue beginning at the leaf tips) the problem may be molybdenum deficiency (younger leaves also twist) .
- Corn plants that become discolored may be revealing some production problems. Yellowing of the plants (beginning with the lower leaves) may signal nitrogen deficiency, drought conditions, or ponded conditions (standing water can produce nitrogen deficiency). Yellowing of leaves beginning at the tips may harold potassium deficiency. Purpling or reddening of leaves from the tip back and affecting the lower leaves first may show phosphorus deficiency. Yellow to white interveinal striping on corn leaves may just be genetic or may be magnesium deficiency. If the leaves have white spots that graduate to striping, boron may be deficient. Pale green to white striping can show either iron deficiency (caused this year by the ample moisture) or—along with dark, almost olive-colored lower leaves—magnesium deficiency.
- Stunting or very fine chlorotic stripes in the whorl leaves suggests that the plants be checked for maize dwarf mosaic or maize dwarf chlorotic disease. Individual stunted, tillered plants with twisting and rolled leaves probably indicate isolated plants with crazy top fungal disease (possible this year due to the very wet spring).
- Plants that have top leaves fused so leaves have difficulty emerging ("rat-tailed" plants) may have been exposed to some growth regulator herbicide or may have been mechanically injured during a cultivation or sprayer pass. Corn leaves that are very tightly rolled and very erect show symptoms of growth regulator injury or can simply be exhibiting drought stress. Lodged plants or plants showing "sledrunner" or "goosenecked" shapes may have problems with corn rootworm larvae, corn nematode feeding (usually not a problem in ND), an earlier herbicide damage residual symptom (from a dinitroaniline or a growth regulator herbicide), simple mechanical injury, or from hot, dry, windy weather preventing normal brace root development.
- Corn stalks that show a brown, soft rot on the lower internode with some stalks twisting and lodging will probably be pythium stalk rot or bacterial stalk rot, or heavy European corn borer or stalk borer damage which has weakened the stalks.
- Fused brace roots, as they emerge on the plant, are caused by growth regulator herbicide injury from an application which was applied after the corn was taller than eight inches.
- Soft, glistening white galls that soon become black and dusty on corn stalks, leaves, and later the ear or tassel are from common smut (a possibility this year, from the early, wet spring affect on the early planted corn).
- Ragged plant tissue from shredding or tearing of leaves in fields may be due to hail damage, wind damage, Western corn rootworm beetles (the green upper layer of leaf tissue is stripped), or corn blotch leafminers (window effect, interior leaf is eaten out). Whole leaf or large chunks of leaf removed may be due to armyworms, grasshoppers, fall armyworms, or browsing livestock or wildlife. Holes bored into the stalks caused by European corn borers or stalk borers.
- General lesions, spots or color streaks initially on small areas can be Northern corn leaf spot, gray leaf spot, holcus bacterial spot, fungal leaf spots, Stewart's bacterial leaf blight, physoderma brown spot, or herbicide (contact) damage. Late-applied granular fertilizers or even air pollution can also cause spotting. Anthracnose leaf blight, bacterial leaf stripe, eyespot, and common corn rust also cause lesions that are very distinct in color and shape.

To optimize your corn yields, carefully scout your corn fields through tasseling to determine your production needs.

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MINNESOTA
CROP NEWS

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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, but the process of collecting soil samples for detective work is different from the process used in routine sample collection. Here are some guidelines for this special sampling.

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 as 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 depth as sample collection used for 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 than the analysis of a single sample which is supposed to represent the entire field.

In this issue

Crop Production Tips

Denise McWilliams, NDSU/UM Crop Production Specialist

Common Cocklebur More Abundant on Wet Fields

Common cocklebur migrated to the U.S. with the early settlers and their first shipment of goats and sheep. Since that introduction, it has spread from coast to coast. A member of the Compositae family of plants, both sterile and fertile flowers appear on various heads on the same plant. The seeds are noticeable from their spiny burs that are two-celled with one ovule in each cell. The ovules germinate in consecutive seasons—a smart tactic that makes the weed difficult to control. This weed has not always been such a bur in the farmer's and rancher's side. At one time, cocklebur was considered a beneficial herb. The leaves, seeds and roots of the species known as the heartleaf cocklebur were used in Europe as a diuretic and as a tonic to purify the blood. American Indians used the leaves of the showy cocklebur species to counteract hydrophobia. Common cocklebur is poisonous to all classes of livestock, especially swine. The cotyledonary stage seedlings contain the poisonous hydroquinone. Common cocklebur is especially abundant in areas where receding water has exposed previously submerged land.

Marketing and Education Are Valuable Tools

Now that planting has wound down, really think about how you are going to market that corn and soybean crop. Farmers who market themselves as quality producers can demand increased premiums for better products (delivered as needed). Find out value differences among varieties—and not just for specialty crops. Over time, diversity of cropping traits will be more prominent (load-to-load variations from different fields, niche trait marketing, organic marketing) and easier to measure! Farmers and elevators will shift their focus and learn from one another how to pull in crop price premiums and increase profits. Segregation and transportation of the crop may be two of the biggest challenges. Different types of grain will have to be kept separate and must be handled better, without the overheating or drying that causes cracking and dockage. Future farmers will lessen the gap between themselves and the end user or sign under grower contracts, hence the current boom in farmer-owned cooperatives that allow specific production for niche markets. Don't forget to keep up on the changes! Education is a farmer's most valuable tool.

Cultivator Blight Got You Down?

Even experienced drivers find working hundreds of acres with a cultivator tedious, but beware the inexperienced tractor driver who finds magically disappearing corn and soybean plants suddenly appearing! One way around this is to use guidance systems on the tractor. These mechanical, hydraulic, or electronic systems quickly restore alignment with less driver stress, closer cultivation to the row, great precision on sloping fields and increased acreage coverage due to the ability to drive faster. These systems are extremely useful when running a cultivator to break up soil crusting in late-planted soybeans. While these guidance systems take the mystery out of cultivator blight, they also increase wear on tractor parallel linkage and other equipment joints due to the frequency of the re-centering movements.

Point Soybeans to High Yields

Soybean yield depends on the rate and length of time for dry weight accumulation. The rate of dry weight increase in soybeans is slow 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). Point soybeans toward high yields now by monitoring and controlling pests and keeping stands healthy through physiological maturity. Check now for grasshopper damage and control defoliation over 30% prior to bloom or if damage reaches 20% between blooming and pod-filling stages. The grasshopper species that cause soybean injury deposits eggs in fence rows or other undisturbed areas near fields. As dry conditions occur, grasshoppers can move into soybeans and damage can be scattered over the field.

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. Kernel rows per ear is being determined and is strongly influenced by hybrid genetics. Tillers (suckers) 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); yield loss to frost now will be 100%, if a frost occurs; 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.

Benefits of Cultivating Soybeans

Dave Schwartz, Extension Soybean Production

Over the years, crop producers have seen a lot of changes in crop management. Years ago, when few chemicals were available to assist in weed control, crop producers needed to cultivate their soybeans at least twice or their yields suffered immensely. Many new herbicides have come on the market since Treflan was introduced in 1961. Good to excellent weed control can be achieved with the application of two separate herbicide applications and growers have Roundup Ready soybeans as an additional management tool. Now, more than ever, growers are questioning the value of cultivation in their weed control program.

We know cultivation helps keep herbicide resistant weeds in check. As one specialist reminded me, "No weed is resistant to steel." Cultivation cleans up escapes that are missed by herbicides, and that lowers the weed seed bank. We also know that cultivation creates a better environment for root growth by aerating the soil. Many types of bacteria are more productive when soil is cultivated releasing more nitrogen, phosphorus, and sulfur. We know Rhizobia bacteria are more active with aerated soil.

Cultivation takes time. A study by Iowa State University found it takes 16.8 hours to cultivate 100 acres at 4 miles per hour with a 6 row 30 inch cultivator (see Table 1). The timing of cultivation may an issue too. In the ridge till system, soybean yields decrease significantly (30%) when fields were cultivated twice compared to no cultivation and post emergence herbicides. Cultivating soybeans in the later vegetative stages appears to reduce yield in ridge tilled fields as well as conventional fields.

Table 1. Hours needed to cultivate 100 acres

Type of cultivator (no. of rows-rows width)	Speed (mph) 4	5	6	7
6-30 in	16.8	13.4	11.2	9.6
8-30 in.	12.9	10.3	8.6	7.4
12-30 in	8.8	7.1	5.9	5.0
6-38 in.	13.2	10.6	8.8	7.6
8-38 in	10.2	8.1	6.8	5.8
12-38 in.	7.0	5.6	4.6	4.0

Ag professionals who visited the Experiment Station Field Days at Waseca and Lamberton may recall the 1996-1998 soybean herbicide evaluation study. Many different herbicides and combinations were compared over the three year period at both stations. In general, herbicide programs that effectively controlled weeds benefited little by the addition of cultivation. Normally, crop income improved with cultivation if herbicide rates were reduced or herbicide combinations were used that did not effectively control weeds. Soybean cultivation studies at Iowa State and Purdue found similar results.

Producers getting excellent weed control with their herbicide spray program probably don't need to cultivate soybeans. Fields that appear clean will not benefit greatly from cultivation. Cultivation may help when soybeans suffer on high pH soils from iron chlorosis, crusting on heavy textured soils has developed following rainstorms, producers are concerned about the development of herbicide resistant weeds, or enough weeds have escaped the herbicide application that field warrant cultivation.

Soybean Cyst Nematode--Yellowing May Not Be Iron Chlorosis

Bruce Potter, Extension IPM Specialist

Iron chlorosis is in fields at this time. This problem is caused by a complex interaction of environmental conditions with soil chemistry and soybean physiology. Pay attention to the variety and chlorosis rating.

Yellowing in spots that have not previously had chlorosis problems or on a variety with good iron chlorosis tolerance may be caused by soybean cyst nematode. There is some evidence that soybean cyst nematode populations can be higher in high pH (one of the factors involved in iron chlorosis) areas of a field.

Females (developing cysts) can be seen on the roots through a large portion of the growing season. They are visible with the naked eye and have a characteristic size and lemon shape which distinguishes them from nitrogen fixing nodules. As cysts mature they progress in color from white to yellow to tan. To observe females on the soybean roots, dig up plants rather than pulling them. Pulling plants can leave behind a good portion of the root system (where cysts occur). Gently shake loose soil from the roots and look for cysts. If a large amount of soil remains on the roots, immerse the roots in a bucket of water for several minutes. This will wash the soil from the roots without removing the cysts. SCN have several generations per year in Minnesota. Late June through August is a good time to observe female SCN on the roots. Numbers of cysts on the roots, however, fluctuate through the season as generations occur. Do not assume that SCN are not a problem if you do not see cysts the first time you examine roots from suspected plants. Scout again a couple of weeks later.

Soybean roots may be severely rotted from interactions with pathogens and SCN feeding. SCN cannot survive on heavily decayed roots. Check for cysts on the healthier plants on the edge of areas where plants with severe symptoms occur. A soil sample should be taken when SCN is suspected.

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MINNESOTA

CROP NEWS

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

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Crop Production Tips

Denise McWilliams, NDSU/UM Crop Production Specialist

Cool Night Temperatures Reveal Herbicide Selectivity

Recent cool nights experienced in the Valley have revealed some herbicide selectivity among corn and soybean varieties to post applications of herbicides. Situations can occur in which a crop may be injured by a herbicide to which the crop is normally tolerant. This occurs when environmental stresses such as hot or cold temperatures, relatively high humidity, or hail decrease a plant's natural ability to reduce herbicide uptake or deactivate a herbicide. Any stress on a plant takes energy in order for the plant to compensate, energy that normally would be used for other growth and production processes or general defenses. Thus, careful consideration of timing of spraying and an overall crop health understanding is needed by the producer before making that postemerge application. Consider the weather at least one week before and one week forecast after a proposed application along with crop condition to estimate plant tolerance as well as considering the weed growth in the field when making the critical herbicide use decision. Consider alternative cultivation or alternative herbicides that might be less stressful to crop health after or before extreme weather conditions.

Soybean and Corn Growth Continuing after Cool Nights

With the cool nights that occurred in the Valley over the last two weeks hopefully past, crop growth is again continuing. Night temperatures that dropped below 50F lim-

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ited crop growth severely. The colder temperatures required plants to expend some of their stored energy to continue metabolic plant processes through the night rather than providing the stored energy strictly toward growth and development. Indeed, temperature regulates the rate of all chemical processes in the plant; thus it plays a major role in determining the growth rate. It also determines the length of the growing season needed. The base temperature used for calculating heat units for both corn and soybeans is 50F in many growing degree day formulas as temperatures above this range but below 86F are optimum for crop growth.

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 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.

Soybean Stands Will Determine Season Potential

Soybean plants that are now six to eight inches tall should be at the V2 stage and have three nodes with unfolded leaflets (the unifoliolate and two trifoliolate nodes). The lateral roots of these plants should now be proliferating in the top six inches of the soil (soybean roots can penetrate to a depth of five to eight feet, but most roots are located in the upper six to twelve inches of soil). Earlier planted soybeans should be at V3 and be seven to nine inches tall with unfolded leaflets at four nodes (the unifoliolate and two sets, or four, of trifoliolate nodes). At this critical V3 to the later V5 stage, soybeans have axillary buds that can eventually develop into branches, flower clusters and pods, or remain inactive. Branches help compensate for low planting rates or inadequate stand densities as well as compensate losses due to hail or other mechanical damage. However, branching can set pods lower to the ground, leading to potential harvest losses. Good planting rates reduce excess branching (and potential low pod harvest losses) and lodging losses (from high population densities) to optimize crop production.

Troublesome Milkweed was Native Delight

Common milkweed is an unbranched perennial that grows well in fields as well as roadsides. From June to August, the plant can bear sweet-scented, powdery flower heads that are followed by warty follicles (many-seeded fruit from one carpel, which on ripening splits down one side only). These seed follicles ripen on the stalk. Thus, control measures dictate that cutting the "pods" before ripening to help limit spread of the plant. If possible, do not allow the plants to form fruits as seeds are numerous and can float as well as fly, making dispersal widespread. It is exceedingly difficult to eradicate, especially when well established in fertile soil. Adequate herbicide control under various environmental conditions is very difficult and limited (spot treatment with glyphosate; use of dicamba in fallow; picloram in pasture or noncropland; or, use of imazapyr in noncropland). The creeping rootstock aids in the plant's ability to survive. However, the plant was once eaten like asparagus, with very young shoots collected and boiled with multiple changes of water during the boiling as the plant can be poisonous unless prepared correctly. In fact, the Platte River Indians ate the milkweed follicles with buffalo meat and the Chippewa often cooked parts of the milkweed with meat.

The Value Of Research

George Rehm, Extension Soil Scientist

Nearly everyone associated with modern production agriculture realizes that the crop production inputs used today are the end result of countless hours of research and development. Faculty of the University of Minnesota have been and continue to be leaders in much of the research activity that focuses on improved crop production.

From time to time, the faculty are asked to document the value of the research that they do. This might seem like a simple request; but, a reasonably accurate response is very difficult to develop.

Sometimes a research project focuses on a special problem associated with a specific production practice. It is possible to document the value of research in these special situations. The development of potassium deficiencies in corn planted in the ridge-till system is one example of how focused research can solve a special problem.

In 1988, potassium deficiency symptoms were evident in many fields throughout Minnesota when corn was planted in the ridge-till systems. These symptoms appeared even though the soil test for potassium was in the high range. Research designed to provide an answer to this problem was conducted from 1989 through 1991. An application of 40 lb. potash per acre per year was adequate for correction of the problem. This rate produced a yield increase of about 20 bu. per acre.

With current corn prices at about $1.80 per bu., this increase is worth $36.00 per acre. The cost of 40 lb. potash is about $4.80 per acre. Therefore, the return on investment in potash was $31.20 per acre. With about 200,000 acres of ridge-till corn in Minnesota, the statewide benefit from this research would be $6,240,000. This 3-year project was supported by grants which totaled $9,000. Thus the return on investment in these research dollars was substantial.

The benefits of other research projects for the entire state are more difficult to calculate. As a substitute, the benefits are calculated on an acre basis. The study of phosphate fertilization for soybeans is an example of this type of situation.

Recent studies at the West-Central Experiment Station at Morris have shown that use of phosphate fertilizers will produce substantial increases in soybean yield if soil test values for phosphorus are in the low or very low range. The application of 69 lb. phosphate per acre produced a yield increase worth $90.50 per acre. If the cost of the phosphate is subtracted, the return on use of phosphate fertilizer for one year would be $72.25 per acre.

The number of acres with a low or very low soil test for phosphorus and planted to soybeans in Minnesota is not known and would be difficult to determine. Therefore, it is appropriate to calculate the return to phosphate use for soybeans on a per acre basis.

These are but two of the many examples that could be used to document the value of research for improved crop production. There are, no doubt, many others that can be cited.

Plant Disease Clinic

Sandra Gould, Plant Disease Clinic

Samples submitted to the Plant Disease Clinic in June included:
corn—*Rhizoctonia* sp and *Pythium* sp root rot
wheat—loose smut, cultured for storage molds
alfalfa—spring black stem
potato—PVS, alfalfa mosaic virus
oak—oak wilt, anthracnose
Philadelphus—bacterial leaf spot
Viburnum—bacterial leaf spot, *Phyllosticta* sp leaf spot
Rhododendron—*Phytophthora* sp root rot
mum—Impatiens necrotic spot virus (INSV)
daylily—*Collecephalus* sp (leaf streak)
Lamium—Tobacco mosaic virus (TMV)
Sedum—*Pythium* sp and *Cylindrocladium* sp root rot
Ajuga— *Myrothecium* sp leaf spot
sumac—*Cylindrosporium* sp leaf spot

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CROP NEWS

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Reminder - Ag Professional Field School

Kevin Cavanaugh, Agronomy Program Coordinator

The registration deadline for the upcoming Ag Professional Field School is June 28. This year the Field School will offer two sessions, both which will be held at the Southwest Research and Outreach Center-Lamberton. Session I will run from July 13-14 and Session II will run from July 15-16. 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 toward agriculture chemical/fertilizer dealers, seed dealers, agriculture chemical reps, crop consultants, crop production specialists, agronomists, and county Extension educators. A total of 12 CEU have been approved for this program. Each session will offer Soil and Water Management (2.5 hr), Pest Management (7.0 hr), and 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 28, 1999**. 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.

In this issue

Crop Production Tips

Denise McWilliams, NDSU/UM Crop Production Specialist

Check Your Soybeans for Nodulation

Soybean plants that are six to eight inches tall should have their first unfolded leaflets (V2 stage). Nodulation, the symbiotic relationship of bacteria on the soybean roots, can be seen shortly after emergence, but the plant is not actively fixing nitrogen until the V2 to V3 stages. The number and nodules formed on the soybean roots along with the amount of nitrogen fixed increases until the R5.5 stage. Nodules actively fixing nitrogen for the plant are pink or red inside. White, brown, or green nodules indicate that nitrogen-fixation is not occurring. Nitrogen fertilization after planting (other than pop-up or early, limited fertilization) is not recommended as nitrogen fertilizer applied to active nodules will render these nodules inactive or inefficient, depending on the amount of nitrogen applied. Soil nitrogen is utilized over fixed nitrogen, if available in large amounts. Check the health of your soybean nodules and check root proliferation. At V2, soybeans should be rooting down six inches into the soil and by V5 will completely reach between 30-inch rows, which means any cultivation at V5 needs to be very shallow.

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 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
- yellow leaves and spindly plants—nitrogen deficiency or sulfur deficiency (if more pronounced on younger leaves).

Evaluate Your Corn Crop Planting

First it was the cold, wet weather with continued rain and difficulty getting into the fields to plant and spray. Now it is the time to evaluate your corn planting. In a few fields, small corn plants are curved and may have stunted root growth from one or a combination of factors including: shallow planting (corn should be planted two to two and a half inches deep in order to adequately spread the primary, nodal, and eventually the brace roots on the plant so they can better anchor the plant, even in wet years); soil crusting (above or below the corn roots may cause either emergence or rooting problems); cool soil temperatures followed by cool air temperatures in mid-May; or previous herbicide injury that pruned the root system. Other problems in corn that might lead to plants lodging or growing in a curved "sledrunner" or "gooseneck" shape include corn rootworm larvae feeding damage, nematode feeding damage from species that are parasitic on corn roots, mechanical injury, or hot, dry weather and winds that prevent normal brace root development.

Redroot Pigweed, a Plant Equivalent to Survival of the Fittest?

Redroot pigweed is a major weed from a family of weeds that encompass 900 widespread species. Pigweed seed from ancient Native American campsites in New Mexico have been dated as 6,800 years old (luckily not viable), at least 2,400 years older than samples of maize found. It is an annual with a red or pinkish taproot and is predominantly wind-pollinated, although insects may pollinate it under certain circumstances. It seldom grows in shade and can easily contaminate crop seed with its small, shiny, black seed that accumulate at up to 100,000 seed per plant. Buried seed can remain viable for up to 40 years, seed from a single plant may vary in dormancy characteristics and germination requirements (depending on temperature and photoperiod during maturation). It has a branching growth habit and can initiate elongated inflorescences from leaf axils if the terminal panicle is damaged. It may assume an almost prostrate growth habit in cases of extreme disturbance. It easily resprouts from its taproot and easily transplants in moist soil conditions under ordinary farm tillage. While easily controlled with herbicides, redroot pigweed is a weed with which to contend because of its many growth adaptations.

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Why Has Soil Crusting Been a Concern?

Soil crusts this spring have created germination and rooting problems in crops. Crusts are created by the breakdown of the soil's structure by flowing water, raindrops, or through freeze-thaw action. In the freeze-thaw action, crusts are created with the puddling effect as ice forms, melts, and reforms. These particular crusts can be 3/8- to 5/8-inch thick as compared to simple raindrop-impact crusts that are often only 1/4-inch thick. Crusts are usually less than two inches thick, but are massive because individual soil particles fill pore spaces on the surface and prevent water movement, air entry, and seedling emergence from occurring. Long-term problem elimination of crusting can be accomplished by maintaining plant cover or crop residues to reduce raindrop impact, adopting management strategies that increase soil aggregate stability, using practices that increase soil organic matter content or reduce the sodium ion concentration in the soil, using a rotary hoe or row cultivator to shatter crusts, or using sprinkler water to reduce restriction of seedling emergence.

Leafhopper Populations High in Minnesota

Dr. Ian MacRae, Extension Entomologist

Populations of both Aster and Potato Leafhopper are high in Minnesota this spring. These insects become reestablished in the state each year as individuals are blown north from southern states where they overwinter. Leafhoppers are currently being reported in potato, dry beans, alfalfa, and even small grains. Although only the first three crops are at risk from leafhoppers, populations in small grains may move into crops that can be damaged by these insects.

Potato Leafhopper is a small (1/8"), pale lime-green, wedge-shaped insect. The adults are winged and move very rapidly. The nymphs are similar to the adults, only smaller and without wings. Aster leafhoppers are roughly the same size and shape as Potato Leafhoppers but are brownish gray with a line of dark spots between their eyes. Both insects have sucking/piercing mouthparts, resembling straws, with which they suck plant sap. In addition, they inject saliva into the plant to aid in ingesting the liquid diet. This saliva is toxic to the plant. Initial feeding often appears as small pitting or discolored spots. Heavier feeding results in crinkling of the leaf and "hopperburn," a characteristic change in coloration as the leaves turn from green to yellow to reddish brown. Hopperburn first appears at the terminal edge of leaves and impairs plant growth. Potentially damaging populations of leafhoppers should be controlled before the onset of these symptoms.

Leafhopper nymphs tend to feed on the underside of leaves and walk to the other side of the leaf when disturbed. Nymphs cause more damage to crops than do adults due to their greater numbers and higher feeding rates. In addition, adults are more mobile and tend to feed on a number of different plants while nymphs usually remain on the same plant until they become adults.

In dry beans, the treatment threshold is one leafhopper per trifoliate leaf. Leafhopper damage from adult feeding is unusual but has been reported in dry-bean fields this year. Reduced rate applications have been effective against adults. When treating nymphs, the lower level of the label rates is recommended. Populations of nymphs are generally more numerous than adults and by the time nymphs are present, the plant canopy is fuller, resulting in more plant area to be treated. Insecticides labeled for control of leafhoppers in dry beans include Asana XL, Dimethoate EC (Cygon, De-Fend), endosulfan (Thiodan, Phaser), Lannate, Malathion 57 EC, Orthene 75S, and Penncap-M.

In potatoes, treatment thresholds for populations of nymphs are 1 nymph per 10 leaves. Scouting for nymphs must be done by selecting mid-leaves and counting the number of nymphs present. Adult leafhoppers can be scouted with a sweep net. Sweeping in a pendulum motion (one swing across the body and back) through the canopy, complete a series of 20 pendulum sweeps in at least 5 locations, ensuring good coverage of the field. Treatment thresholds are 10 - 20 adults for every 20 pendulum sweeps. Insecticides labeled for control of leafhoppers in potato include permethrin, Asana XL, carbaryl, Dimethoate EC (Cygon, De-Fend), endosulfan (Thiodan, Phaser), Furadan 4F, Guthion, Imidan, Vydate, and Penncap-M. Reduced rates are also recommended for treating adult leafhoppers in potato.

Update on Cereal Insects

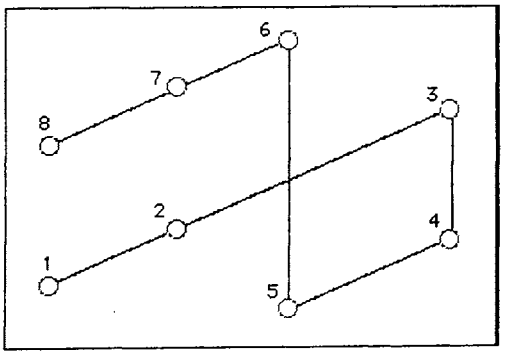
Dr. Ian MacRae, Extension Entomologist & Dr. Jochum Wiersma, Small Grains Specialist

Aphid populations in small grains have started to rise in some areas of the state. The recent cool, wet weather is ideal for aphid reproduction. Cereal aphids do not overwinter in Minnesota, rather they overwinter in southern states and populations are reestablished by individuals carried north on weather fronts each spring.

Aphids have piercing/sucking mouthparts and feed on plant sap. This causes long-term physiological stress on the plant, and heavy aphid populations can cause stunting and grain loss. However, yield loss generally results from either very high populations on plants or moderate populations established on plants for extended periods of time. Consequently, it is important to treat early; ideally, treating for aphids should be done when wheat is at the flag leaf stage. This means scouting wheat at or before flag leaf. Select 100 tillers in a way that ensures even coverage of the field (see Figure 1), treat if >80% of the tillers have aphids on them.

In the past, aphid insecticides have been tank-mixed with fungicides targeted against leaf diseases and applied when wheat was at the flag leaf stage. Since Fusarium Head Blight has become the major disease concern in small grains, most fungicide application is now occurring when wheat is heading. There is a temptation to delay aphid treatment until heading and tank mix the insecticides with fungicides to save money on application costs. Research suggests this is too late to avoid loss of yield from aphid feeding; by heading, most of the yield loss from aphid feeding has already occurred. Treating earlier will prevent aphid populations from developing to the point where yield is lost. One way to save on insecticide inputs is to scout fields to ensure insecticides are only applied when necessary.

Figure 1. 'Adapted Z' field sampling pattern.



Early and continued scouting of aphids this year is also recommended because of the amount of late planted wheat. These plants are at greater risk of being exposed to aphids vectoring Barley Yellow Dwarf Virus (BYDV). This plant disease will cause discoloration and stunting of cereals. Isolated fields have been reported in North Dakota with low infestation rates, but as the season progresses and earlier planted wheat matures, aphid populations will move into younger, later planted fields. As aphid populations grow through the year, a higher percentage of aphids will be vectoring BYDV and so these later planted cereals will be at a greater risk of contracting this disease.

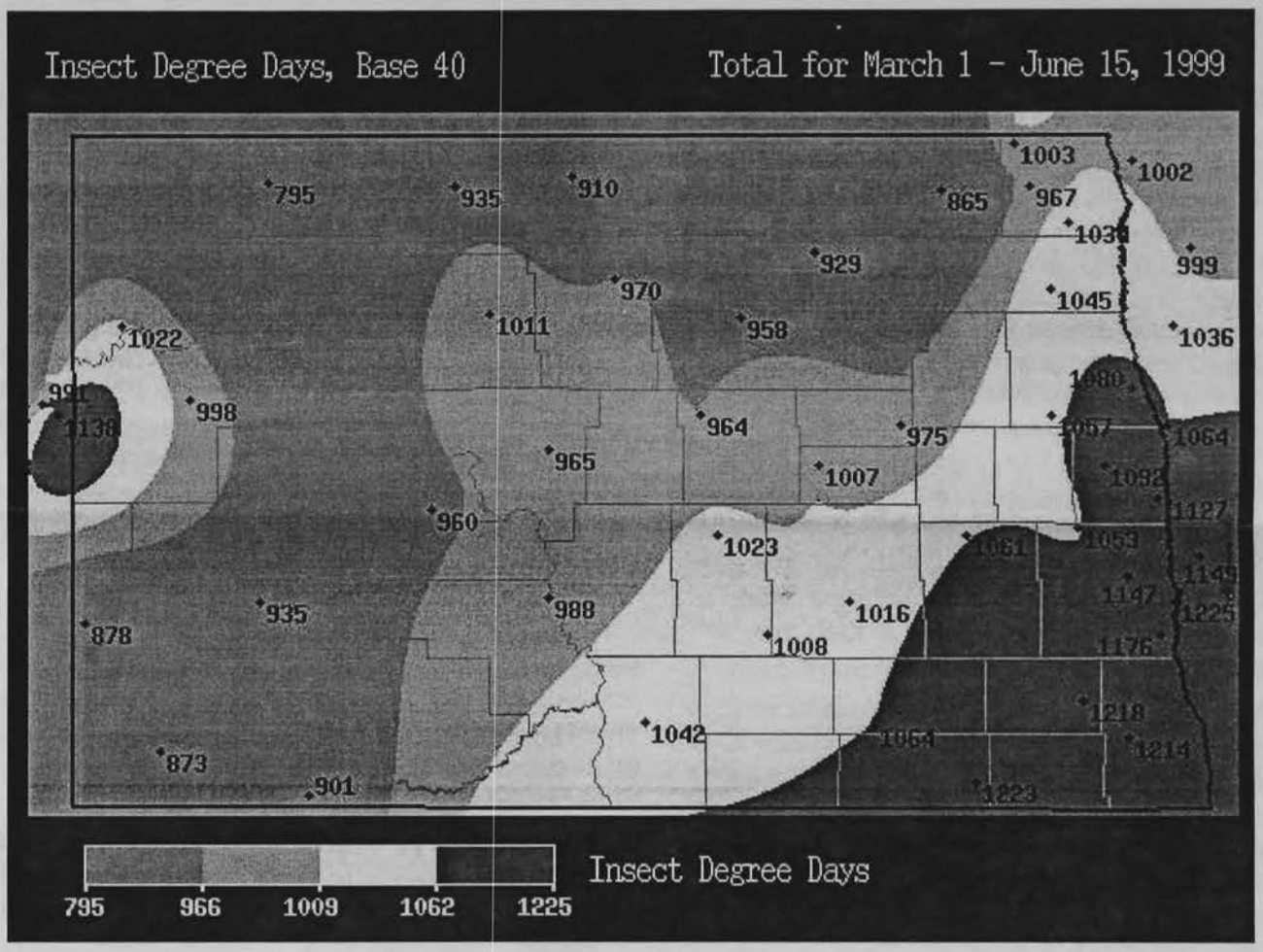
Barley thrips have been noted in a number of cereal fields in the Red River Valley. Populations of this insect usually expand when the weather is hot and dry. However, high populations in cereals now may indicate problems later. The threshold for Barley Thrips is 8 per head. To scout for Barley Thrips, you must select and open tillers, counting the thrips that are present.

Finally, Orange Wheat Blossom Midge (OWBM) emergence will soon start throughout northwest Minnesota. Accumulated growing degree days (GDD) for OWBM indicate that the counties in the southern valley have reached the 1200 accumulated GDD (see Figure 2 at the top of the next page). This marks the start of the emergence of OWBM. Peak emergence is at 1400 GDD and emergence subsides at 1600 accumulated GDD.

This early emergence is good news. Many late planted fields will escape the OWBM because emergence will be completed before heading of the late planted crop. Early planted fields, especially those planted on wheat, are at risk and should be scouted for presence of OWBM. 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. The only insecticide labeled for control of OWBM in small grains is Lorsban 4E-SG.

Continued at the top of the next page.

Figure 2. Accumulated degree days for North Dakota and NW Minnesota as of June 15, 1999.



Small Grain Disease Forecasting And Decision Support

Jochum Wiersma, Small Grains Specialist

Most of you should be familiar with the decision key for fungicide applications in small grains. A copy of the decision key was printed in the 1998 June issue of **Prairie Grains Magazine**. If you would like to receive a copy, please contact your local Extension office or me. In addition to the decision key, Dr. Len Francl, NDSU plant pathologist, has developed a disease forecasting system. The system forecasts the risk for Fusarium head blight (scab), tan spot, and/or Septoria leaf blotch development during the growing season. The model combines weather data collected by the NDAWN weather system and spore counts from air samples to provide localized forecasts.

The information is available through a toll-free number as well as on the Internet. The latest Fusarium spore counts can be heard on a recorded message when calling 1-888-248-7357. More complete information is available on the Internet (www.ag.ndsu.nodak.edu/cropdisease/). The leaf disease forecasts are updated daily while the spore samplings of Fusarium head blight are updated three times a week.

Be advised to use the forecasting tool, the decision key, as well as the yield potential of the crop and weather forecast to determine whether a spray of a fungicide likely will be economical. If unsure, contact your local Extension office or me.

Prevented Planting: Lots of Options

Zachary Fore, Extension Cropping Systems Specialist

It is time to make lemonade out of lemons. Many farmers, kept out of fields for all or much of the spring by excessively wet weather, are becoming more familiar than they would like to be with the crop insurance term "Prevented Plant." Prevented planting (PP) is not a desirable option, resulting in a small positive net return at best. However, a small return (or a small loss) is better than potentially large losses from late planting in very wet conditions. The next question is, "What do I do with prevented plant fields?" Fortunately, there are a number of options. Whatever option you choose, you want to achieve one or more of the following things:

1) Increase your chances of being profitable next year.

2) Make money on prevented plant fields by haying/grazing.

3) Establish a perennial crop, such as alfalfa or Kentucky bluegrass, or a winter annual crop such as winter wheat or winter rye.

There are some rules you will need to abide by set forth by the Risk Management Agency (RMA) and the Farm Service Agency (FSA). RMA requires that crops grown on prevented plant acreage cannot be harvested as grain. Crops can, however, be grazed or used as hay, and the hay produced can also be sold. Sweet clover, Kentucky bluegrass, and other fall-seeded perennial crops are permissible cover crops on PP acres, as are sudangrass, millet, dry peas interseeded with grains or alone, and small grains, as long as these crops are not harvested for grain. Consult with your crop insurance agent about any other crops in question.

RMA officials have also clarified that alfalfa planted in August or early September for fall establishment is allowable on PP acreage. Alfalfa cannot be planted this spring, however, either to establish the crop or to use as a green manure plow-down. Sunflower cannot be planted on PP acres either.

Producers should also be aware of cover crop requirements by the government for idled contract acreage. By signing Form CCC-478 through the Farm Service Agency, producers agree to protect idled contract acreage (base acres) from erosion and weeds. A minimum 30 percent of the soil surface of idled acreage with less than 3 percent slope must be covered with crop residue. Minimum residue of 40 percent is required for fields with more then 3 percent slope. Clean tillage may be used on fields with less than 3 percent slope, provided land is protected from wind and water erosion during the fall and winter by one or more approved practices.

The cover crop seeding deadline for idled contract acreage is August 20. An extension of up to 15 days is possible if seeding is delayed by reasons beyond a producer's control. Small grains seeded after September 1 must be winter wheat or winter rye. Contact your local FSA office for more details.

Okay, now that we have all the rules, what are the best options?

1) **Summer Fallow**. Many growers will choose to summer fallow and make improvements to PP fields. (Remember the FSA cover crop requirements.) Many improvements can be made using this option, including:

- Drainage. Consider surface and subsurface drainage, as well as land contouring to improve runoff.
- Remove rocks.
- Control weeds - especially perennials. As always, all weeds should be prevented from going to seed.
- Reduce disease potential. A fallow period will allow disease inoculum to decompose as long as no disease host is present. Many weeds are hosts for diseases that infect crops, so weed control will also aid in disease control.

2) **Establish a Perennial or Fall Seeded Crop**. Many of the improvements listed in #1 can be made, and a field can be prepared for a fall seeded crop. Options here include:

- Winter wheat or winter rye
- Alfalfa (as long as it is not seeded until August), or another fall seeded legume.
- Kentucky bluegrass or other fall seeded perennial grass crop.

3) **Graze/Hay**. This is an excellent option for livestock/hay producers. There are many options here. Fields can be planted then grazed, hayed, green chopped, or any combination thereof. Remember, you don't have to have livestock - hay can be sold. There are many crops that could be planted using this option, including:

- Legumes. Legumes are an excellent option that can produce high quality forage and are excellent green manure crops (see option #4). There are many legumes that could be used, including:

  Soybeans - Soybeans are a warm season crop that will do very well in warm summer weather. Soybeans can be grazed, hayed, green chopped, or plowed down as a green manure, but not harvested for seed.

  Clovers - red, white, alsike, ladino, kura, sweet, berseem. These are perennials - except for sweet

clover, which is a biennial - that can be tilled up or left for subsequent years. They are usually seeded in early spring or August, and establishment may be hit or miss during the hotter, drier part of the summer. Sweet clover is more suitable for plow-down than for grazing/haying.

Field Peas - Field peas are easy to establish and grow well in our climate. However, it is a cool season crop and growth will be reduced by hot weather.

Birdsfoot Trefoil - Birdsfoot trefoil is a perennial that is usually planted in the early spring. Getting a good stand may be very difficult when planted in June.

Hairy or Crown Vetch - These are perennials that are usually planted in the early spring or August. Establishment may be difficult when planted in June.

- Sudangrass, sorghum sudangrass, and millet. These are warm season grass crops. They can produce a large quantity of reasonable quality forage if managed properly.
- Small Grains - Wheat, barley, or oats can be planted and grazed, hayed, and/or green chopped. These are cool season grasses. Growth will be reduced by hot weather, but they are easy to establish, seed is cheap and available, and they will provide cover.
- Mixes - Legumes can be mixed with grasses, such as peas and oats, which is a common forage mix. Peas and soybeans could be mixed to take advantage of cool and warm weather. There are literally dozens of other potential mixes that might be suitable for various situations.

4) **Green Manures.** A crop that is grown for the purpose of tilling into the soil to improve soil structure and/or soil fertility is referred to as a green manure. Any crop can be used as a green manure. However, legumes are particularly well suited because of their ability to fix (make available to plants) atmospheric nitrogen. (Make sure you use the proper seed treatment inoculant with any legume). A legume can be used for hay or grazing, and then tilled in as a green manure. However, the green manure effect is increased as the amount of plant material tilled in increases.

All the legumes listed in #3 can be used as green manures. However, those that produce the most plant material will usually make the best green manures. The N benefit varies depending on which legume is used, how much soil N is present, and other factors. As a rule of thumb, for each ton of forage produced, 40 pounds of N will be added to the soil for use by subsequent crops.

In addition, green manures can improve soil structure by adding a small amount of organic matter and by 'loosening' the soil. Sweet clover is particularly known for its ability to improve soil structure. Sweet clover has a large, long tap root that appears to have a very beneficial effect on soil structure.

Buckwheat, a non-legume, can also be used as a green manure. Many believe that buckwheat is very good at extracting phosphorus from the soil and increasing P availability to subsequent crops.

As you can see, there are many options. This article is just a very brief overview. You will likely need to consult with your crop advisor to obtain more detailed information regarding the specific options that fit your situation.

Application of Fungicides For Suppression of Fusarium Head Blight

Jochum Wiersma, Small Grains Specialist

In 1998, the Extension Service of NDSU and the University of Minnesota made equipment recommendations to improve the efficacy of fungicide to suppress Fusarium Head Blight. The NDSU Extension Service publication, *Application of Fungicides for Suppression of Fusarium Head Blight or Scab* (AE-1148) summarized the recommendations based on the research at NDSU.

This research has continued over the winter months with greenhouse studies and those additional findings are reported in the June issues of **Prairie Grains**. If you are interested in receiving a copy of either publication, please contact your local Extension office or me. Both publications can also be found on the web at the Small Grains website (http://www.smallgrains.org) or the NDSU Extension Service (http://www.ext.nodak.edu/).

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MINNESOTA

CROP NEWS

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

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The Color Of Corn

George Rehm, Extension Soil Scientist

In travels across the state during the past two weeks, we've seen corn in various shades of greenness. Some fields have a nice, preferred, dark-green color. In others, the color has been a lighter green. Corn growing on the sandy soils and the spots in fields that are sandy takes on a yellow appearance.

Obviously, there is not a single cause for the off-color corn. The light green to yellow color is a good indication of a shortage of nitrogen or sulfur or both. A temporary shortage of nitrogen was probably the cause of the majority of the light green corn growing on the non-sandy soils. The color of the corn on the majority of these fields has improved dramatically after the hot, humid weekend of June 5 and 6. This hot weather probably stimulated mineralization of soil organic matter with subsequent release of nitrogen. Small amounts of additional nitrogen are needed to improve the color of corn at this early stage of the growing season.

The corn growing on sandy soils that has a yellow appearance is probably sulfur deficient. The yellow color is usually accompanied by a striping for the full length of the young leaf. The corn growing on the sandy soil had this appearance following emergence even though sulfur fertilizers had been broadcast and incorporated before planting or applied in a starter fertilizer. Excessive rainfall probably moved the sulfur below the roots of the young plants.

Sulfur deficiency symptoms were persisting in some fields into the week of June 7. If the yellow color of these fields does not improve or disappear, an application of sulfur is suggested. For non-irrigated sandy fields, the use of ammonium sulfate at a broadcast rate of 100 lb. per acre is suggested. This fertilizer is very soluble and should move to the roots following cultivation or rainfall.

If growers have the capability of injecting fertilizer into the irrigation water, fertigation is a good option. The use of a mixture of 28-0-0 and 12-0-0-26 is suggested for this situation if the corn remains yellow. A mixture of 7 parts 28-0-0 to 3 parts 12-0-0-26 is suggested. This mixture should be applied at a rate of 10 gallons per acre if soils dry to the point where irrigation water can be used.

There have also been reports of purple corn when corn was planted where there was no crop last year. This situation is known as the "fallow syndrome." Even though this corn looks bad early in the season, it should improve as the season progresses and develops into a near-normal crop.

In this issue

For more information contact Extension Plant Pathology at 612.625.6290

On-Farm Grain Storage Costs: Consider all the Factors

Bill Wilcke, Extension Engineer

As you make decisions about how and when to market your grain and whether to store it, make sure that you consider the full costs of storing grain. Here are some of the factors that determine the total cost of storing grain.

Ownership costs for bins and equipment.
If you are considering adding storage space, you need to include the cost of bins (or of remodeling other structures for grain storage), aeration equipment, grain handling equipment, grain temperature monitoring equipment, construction costs, and electrical wiring.

When you estimate annual costs for equipment, consider that most bins will last at least 20 years and most fans and motors will last 5 to 10 years. Besides purchase costs, factor in interest on the money, property taxes, and insurance. If you already have storage space available, you will be paying these costs even if you decide not to store grain. Annual costs for owning storage space often amount to 15 to 20% of the initial cost to build storage.

Opportunity cost for the value of the grain.
Grain isn't worth as much as we'd like right now, but it's still worth something and you need to consider the interest on the value of the grain as a storage cost. An alternative to storing grain is to sell it and use the proceeds to pay off loans (save interest expense) or invest the proceeds and earn interest. Multiply the value of the grain by the interest rate saved or expected interest rate earned to get the opportunity cost.

Extra shrink and drying costs for drying to lower than market moisture.
If crops are sold at harvest or soon after harvest, they can be delivered at market moisture (for example, 13% for soybeans and usually 15% for corn). But if crops are stored into warm weather, they should be stored at lower moisture contents to reduce risk of mold and insects. Selling grain at less than market moisture sometimes involves extra drying costs ($0.01 to $0.03 per bushel per percentage point) and always involves loss of water weight that could have been sold at the price of grain. (Water shrink, percent weight loss per percentage point of moisture loss, equals 100 divided by 100 minus the final moisture content.)

Extra dry matter loss during handling and storage.
Even with careful storage management, you can expect to lose 1 to 2% of the grain's weight due to loss of dust and kernels during handling and due to consumption by mold and insects. If grain is not managed carefully and mold and/or insects become a significant problem, you can expect extra costs to solve the problem (moving, cleaning, redrying, or chemically treating the grain), extra dry matter losses, and possibly discounts to the price when grain is sold.

Electricity costs for aerating and moving grain.
Electricity costs per bushel for aerating and moving grain are very low, but total electricity costs can add up. You can get a very rough estimate of total electricity costs for each fan or grain conveyor by multiplying the horsepower of the motor, the expected number of hours of operation for that motor, and the price of electricity in $/kWh. Avoiding aeration to save electricity costs is likely to result in mold and insect problems and is not a good way to save money.

Labor for checking and handling grain.
Each bin of stored grain should be checked about once a month during winter and about every two weeks during warmer weather. Also, some extra labor is required to fill and empty bins (especially for flat storage or other structures remodeled for grain storage). Estimate the number of hours of labor required for checking and handling grain and multiply by the cost per hour for hired labor or the value of your own time to get total labor costs for storing grain.

Add up all of these factors plus any factors that are unique to your farm to get total grain storage costs. Compare total costs for on-farm storage to off-farm storage charges to decide whether you should store grain on your own farm or hire someone else to do it. (Don't forget that the opportunity cost for the value of stored grain applies for both on-farm and off-farm storage.) Compare total storage costs to expected increase in crop value to decide whether storing the crop is likely to be profitable.

Soil Fertility Research Activity in 1999

George Rehm, Extension Soil Scientist

Various soil fertility research projects are being conducted throughout Minnesota in 1999, at the University of Minnesota Research and Outreach Centers as well as in fields of cooperating farmers. These diverse research activities are being conducted with several crops on a wide variety of soils representative of the major agricultural soils of the state. A brief description of the research projects and general location are provided below. If you have an interest in viewing one or more of the research projects as we go through the growing season, please don't hesitate to get in touch. We can always arrange for a visit to the research site.

Here is a partial listing of the soil fertility research projects.

1. Strategies to Maintain Soil Test Levels for Phosphorus and/or Potassium in the Medium Range:
   - Olmsted County
   - Southern Research and Outreach Center, Waseca
   - Southwest Research and Outreach Center, Lamberton
   - West-Central Research and Outreach Center, Morris
   - Northwest Research and Outreach Center, Crookston
2. Rates and Sources of Sulfur for Corn Grown in Ridge-Till Planting Systems:
   - Watonwan County (2 locations)
3. Potential Development of an Alternative Soil Test for Potassium:
   - Wadena County
   - Fillmore County
4. Phosphate Rate and Placement for Wheat Planted With an Air Seeder:
   - West Polk County (2 locations)
5. Rate and Placement of Urea for Wheat Planted With an Air Seeder:
   - West Polk County
6. Fertilizer Application Practices for Soybeans Seeded With an Air Seeder:
   - Sibley County (Phosphate Variable)
   - Fillmore County (Potash Variable)
7. Evaluation of Seed Placed Materials to Reduce Severity of Iron Chlorosis in Soybeans:
   - Grant County
   - Swift County
8. Evaluation of Iron in Coated Fertilizer for Corn Production:
   - Grant County
9. Lime Rate and Source for Soybean Production:
   - Jackson County
10. Evaluation of Rate and Placement of Poly-Coated Urea for Corn Production:
    - Central Lakes Ag Center, Staples
11. Determining Nitrogen Credits for Alfalfa for Subsequent Crops of Edible Beans and Corn:
    - Central Lakes Ag Center, Staples
12. Timing Nitrogen Applications for Production of Irrigated Edible Beans:
    - Central Lakes Ag Center, Staples
13. Evaluation of Nitrogen Ranges for Production of Grass/Legume Mixtures:
    - Central Lakes Ag Center, Staples
14. Topdress Applications of Phosphate and Potash for Alfalfa Production:
    - West-Central Research and Outreach Center, Morris
15. Evaluation of Phosphate Management Strategies in a Corn/Soybean Rotation:
    - West-Central Research and Outreach Center, Morris
16. Economic Evaluation of Strategies for Precision Farming:
    - Southwest Research and Outreach Center, Lamberton

In addition to these research activities, soil fertility is a major component of three demonstrations:

- Minnesota Forage Expo, East Polk County
- Farm Fest, Redwood County
- Nitrogen Management for Edible Beans, Wadena, East Ottertail, Hubbard Counties

This list is not complete. There are more projects under the leadership of Dr. Albert Sims, Dr. Neil Hansen, Dr. Jeff Strock, Dr. Neal Eash, Dr. Gyles Randall, Dr. John Lamb, Dr. Carl Rosen, Dr. Mike Schmitt, Dr. Gary Malzer, and Mr. Tim Wagar.

Crop Production Tips

Denise McWilliams, NDSU/UM Crop Production Specialist

Corn Progress Already Determines Yield

Much of the corn planted in the Valley has emerged. At the second-leaf stage, corn has already initiated the first whorl of secondary (or nodal) roots above the primary root system. Nodal root growth begins to turn downward more as soil temperatures increase and the surface soil layers become drier, making the secondary roots the major water and nutrient supplier for the plant as well as anchoring the plant. By the third-leaf stage, corn still has the growing point below ground but leaf and ear shoots are already being initiated and will be complete structures by the fifth-leaf stage. Even a microscopically small tassel will be present by the fifth-leaf stage. Crop conditions that delay corn development progress during the second- to fifth-leaf stage in corn will limit yield by affecting root, leaf and ear initiation. Limits on plant growth will directly affect yield.

Corn Likes Fertility but Dosage Rate Affects Staygreen

Corn is a crop that uses large amounts of nitrogen and potassium and, to a lesser extent, phosphorus. Corn depends heavily on phosphorus near the roots early in the season. From knee-high on, corn develops an extension root system that allows scavenging of nutrients, but the greatest root growth of corn is still in the surface six to nine inches. Supplemental nitrogen may be helpful for corn up to the sixth to seventh-leaf stage (between now and the end of June). Anhydrous can be applied up through the eighth-leaf stage, but some root pruning may occur if applied at or past this stage. Urea can also be top-dressed with the granules creating some tissue burn, but this will only be cosmetic and not yield-limiting. Urea can then be incorporated in a cultivation pass. UAN-28 followed with cultivation will also work. Yields with only fall-applied N may be those most in need of supplemental N. Losses from the wet spring will be greater when the N was applied earlier in the fall and where urea was used. However, when making additional N applications, scale down the amount to only what is really needed this growing season. Excess N application will lengthen the staygreen of the corn crop.

Soybeans are Emerging

Recent moist conditions and warming soils have allowed a quick emergence of soybeans within 3 to 5 days in the Valley region. Field emergence of soybeans generally requires a minimum of 5 to 7 days, but can be up to 12 days or longer if conditions are unfavorable. Recent rains have also allowed some soybeans to emerge from previously crusted soil conditions that were holding back soybean appearance. Soybean varieties differ in their germination rate and their ability to emerge from deeper depths, making seed placement very important to crop success this year. Thus, now is a good time to evaluate among varieties for adaptation to extreme conditions. Stand damage caused by planting wheel traffic is generally not a serious concern as partial recovery or compensation by plants in adjacent rows will occur (except in extreme cases where continued crusting also limited stands). Evaluate your varieties as the season progresses. Whether the summer remains cool and wet or dries out, the soybean fields will have to be able to compensate. Consider cultivation of heavier soils that are dry enough in order to encourage soybean root growth (for better compensation ability later) and to help eliminate weed competition.

Soybean Can Emerge Quicker and Compensate Better than Corn

Soybean seed can begin germinating when the seed has absorbed enough water to equate to about 50% of the dry seed weight. So under adequate soil and air temperatures and moisture regimes, soybean can germinate in less than half a day. Emergence from soil depths may take an additional two to three days, depending on adequate growth conditions. Like corn, soybean yield is affected by temperature or moisture stress, especially if it occurs during flowering and pod fill. However, unlike corn, soybeans produce excess flowers on the plants. Usually only 25-40% of a plant's flowers develop into mature pods with the remaining 60 to 75% of the flowers or pods aborting and never contributing to yield. Day length also affects most soybean varieties grown in North Dakota and Minnesota so that late-planted soybeans may hasten their development toward maturity with less yield loss than other late-planted crops.

Why Weeds Survive on Cropped Land

Each weed species has specific characteristics that affect its ability to survive and also determine control of that weed. Some of the reasons weeds are difficult to control translate into the reasons they survive on cropland. Weeds have the ability to compete using vigorous vegetative growth for sunlight and also have quick proliferation of roots, allowing the weed to scavenge for soil minerals and water. The number of seed produced and the timing of seed germination allow weeds an edge against crops. A single weed plant may produce a large number of seed before or even after control measures are applied. The weed seed may have variable dormancy so that some seed remain dormant, with only a portion germinating each year, making the weed problem persistent for years. Many weeds can withstand clipping or mowing. Quick regrowth, fast seed production and rapid storage of lost carbohydrate reserves in stems and roots allow weeds to recover. Low growth habit may help preserve some weeds on cropland. Also, certain weed species may be more resistant to diseases, insects or even herbicides. Resistant plants tend to increase in areas where they are commonly exposed to the factors that may weaken crop plants.

Canada Thistle is a Survivor

Canada thistle is one of the most resilient weed species since its introduction to the United States over three centuries ago. In studies where the seed was stored in fresh water to break seed dormancy and increase germination, 50% of the seed still germinated after 36 months in water. The roots can penetrate 20 feet deep and the thistle sends up countless new shoots from broken plant parts or from rhizomes. On the average, the plant can produce 680 seed. This weed is dioecious however, so staminate and pistillate flowers are on different plants. Because of this, large patches of similar plants may not produce any seed! But the patches can increase in size through the creeping root system. On plants that do produce seed, the seed mature rapidly and can germinate within eight to ten days after pollination. Consider using both mechanical and chemical control on this weed in order to stress the root system and achieve long-term control.

Quackgrass, Also Known as the Devil's Grass

Ever wonder why quackgrass is such a difficult weed to control? Quackgrass not only infests all of the northern United States but also southern Canada, almost all of Europe (its native home) and parts of Asia. It even grows in Alaska, past the Arctic Circle in Norway, and down through New Guinea. It infests over 32 crops in more than 40 countries. The seed is wind-pollinated and virtually self-sterile, making cross-pollination necessary to produce seed. However, it can produce 15 to 400 seeds per plant stem with 25 to 40 most common. It is efficient in that 95% of the spikes contain viable seed, with an average of 13 viable seeds per spike. In the lab, the seed remains viable for one to six years, but in a long-term Duvel buried seed experiment the seed survived for ten years. The plant can spread quickly not only by seed but also by rhizomes. Undisturbed, it can grow up to four feet tall and produce over 400 feet of rhizomes and as many branches per year. This weed can also be infected with stem rust, a fungus disease of wheat. Decaying quackgrass residues may also be allelopathic to crops.

Think Long-Range Weed Seed Control

In years of poor crop prices and dismal cropping conditions, some key inputs in farming (such as better crop seed and weed control) are thrown out the door. However, these two inputs alone substantially make or break a farm in the long run. Good, clean, high-germ crop seed is most important. Seed will determine your stand, plant vigor, and yield. Weed control done now affects the farm for years, sometimes decades. Some weed species produce an amazing number of viable seed. Minnesota studies done back in the late 1940s counted weed-seed on 24 different plots across four locations and found 98 to 3068 viable weed seed per square foot down six inches deep in the soil. On a per acre basis, this weed seed bank is between 4.3 million to 133 million seeds in the upper plow layer. Weed escapes can add substantially to this weed bank. Kochia can produce an average of 14,600 seed per plant; wild oats, 250 seed per plant; redroot pigweed, 117,400 seed per plant; Canada thistle, 680 seed per plant.

U of M Supplemental Nitrogen Worksheet For Corn

Michael Schmitt, Extension Soil Scientist and Gyles Randall, Soil Scientist

A simple worksheet was developed in 1992 and has been modified and tested over the years to help folks decide if supplemental, or extra, N is needed. This decision aid is for situations when all of the N was applied preplant, either in the fall or spring, and not for determining N rates in a split N program. Keep in mind that good judgement is still important when using this decision aid and each field needs to be evaluated individually.

The score sheet should be used in June for every field. It asks three questions and scores the responses. The total score reflects what supplemental N action should be taken. Add your scores to determine the need for supplemental nitrogen. With a score of seven points or less, your current nitrogen program is doing fine. With a score of 10 or more, supplemental fertilizer is recommended. A score of eight or nine falls into a gray area and it is recommended that one recalculates the worksheet in a week as the corn height and/or color will most likely change. The "reevaluation" option is only viable as long as one has sidedressing options.

Nitrogen Score Sheet	Points
1. When was the N applied?	
In fall with soil temperatures above 50°F, 4" deep.	5
In fall with soil temperatures below 50°F, 4" deep.	4
In fall, above 50°F, 4" deep, with N-Serve.	4
In fall below 50°F, 4" deep, with N-Serve.	3
In early spring (end of March or in April).	3
In May.	2
2. What was the predominant spring (May) soil condition?	
Normal or dryer than normal.	1
Wetter than normal.	3
There was/is standing water in the fields.	4
3. How does the crop look?	
Taller than 12-16", but chlorotic.	5
Shorter than 12-16" and chlorotic.	3
Shorter than 12-16" and normal green color.	2
Taller than 12-16" and green	1

Exploring Our Global Community: People, Food and Agriculture

Mary Buschette, Program Coordinator, COAFES

Minnesota farmers can talk crops, cows, computers, climate, and cash prices with farmers from other countries at the University of Minnesota's Global Summit (July 7-9 at the Radisson Hotel in St. Paul). The Global Summit is designed to encourage an exchange of ideas between people from Minnesota and the upper Midwest and agricultural leaders from around the world.

Discussion sessions on each of the first two days will allow farmers to exchange ideas and viewpoints. Discussion topics on July 7 will include changes in farming, biotechnology, environmental issues, information technology, and food safety. Topics on July 8 will include international trade, financing agricultural development, precision farming, and value added agriculture.

One of the farmers who will take part in the discussions is Eion Taggart, who has a 160-cow dairy herd in Queenstown, South Africa. Taggart worked on a Minnesota dairy in 1970 and 1971 through the Minnesota Agricultural Student Trainee (MAST) program at the University of Minnesota. His host farmer was Duane Pearson of Ogilvie.

Taggart has served on the board of directors of the second largest dairy co-op in South Africa. The co-op has become a private company, with shares traded on the South African stock exchange. He has also served on the South African National Milk Committee, which represents all the milk producers in the country.

Also participating in the discussions will be Geoffrey Vickers of Chester, England. Vickers is another former MAST student, working on the dairy farm of E. R. Mertesdorf near Vernon Center, Minnesota in 1970 and 1971. Vickers manages a dairy and grain farm and is past president of the corn growers association in his country. In 1993 he was named "Farm Manager of the Year" by the United Kingdom Institute of Agricultural Management and received an award presented by Prince Phillip at Windsor Castle. He has a strong interest in corn, forage, and dairy production.

Bernadett Hamza, of Hungary, will address topics in horticulture. Hamza worked at Linder's Greenhouse in St. Paul in 1995 and on a fruit and vegetable farm in California in 1994. Hamza currently works as a consultant and interpreter for several companies in Europe.

In addition to discussion sessions, the event features speakers from the U.S. and many other countries. Over 60 businesses and organizations will have exhibits. July 9 there will be tours on dairy, hogs, specialty crops, precision agriculture, value-added agriculture, commercial vegetable processing, packaging technology, food product research and development, and urban horticulture.

For a flyer with registration information and more detailed information about the summit, call (612) 625-7061 or e-mail globalag99@coal.agoff.umn.edu. The summit's Internet website is http://globalag.coafes.umn.edu.

Entomology Notes

Bill Hutchison and Eric Burkness, Extension Entomologists

European corn borer — Corn borer first-generation moth flight remains relatively low at our Rosemount (Dakota Co.) site (max of about 20 moths/night). Degree-day accumulations for most of the state currently range from 550-625 (as of June 10th; sine wave method; 50F base), indicating we are at near peak flight (50% of total flight) for the 1st generation (for bivoltine ECB areas of the state).

Alfalfa/Potato Leafhopper — Recent storms, with strong southerly winds, have delivered high numbers of PLH adults to Minnesota over the past 10 days. PLH counts are generally above threshold in many southern Minnesota alfalfa fields (e.g., 3-5/sweep at Rosemount). Thresholds range from 0.5 to 2.0 PLH adults/sweep for alfalfa heights of 0.5 to >12 inches, respectively.

Any fields still less than 8-10 inches in height should be scouted for PLH. All labeled insecticides work well (e.g. all pyrethroids, Lorsban, dimethoate [Cygon]), generally at 1/2 the maximum rates; however, Sevin and malathion will not provide the same amount of residual control.

Reducing Drift Potential of Postemergence Herbicides

Jeffrey L. Gunsolus, Extension Agronomist / Weed Science.

In last week's article I discussed the importance of timely postemergence application for maximizing weed control and yield potential. Two important factors preventing timely postemergence application are wet fields and windy conditions. It is easier to understand why you cannot spray a wet field than it is to understand why you must stop postemergence applications under windy conditions. Everyone has been stuck in the mud, but "seeing" drift during application is more difficult.

Herbicide spray drift is the movement of herbicide from the target area to areas where herbicide application was not intended. Due to the increase in the use of herbicide resistant crops in Minnesota (e.g., Roundup Ready and Liberty Link) this article will focus on drift caused by the movement of spray droplets rather than vapor drift.

Spray particle size is a major contributor to spray drift. Wind will not move a large droplet as far as a small droplet. Droplet size can be increased by reducing spray pressure, increasing nozzle orifice size, special drift reduction nozzles, and additives that reduce spray viscosity. Table 1 shows the influence of drop size on the potential distance of drift. Note that as droplet diameter decreases the longer it takes for a droplet to fall to the ground and the farther the droplet can travel under a mild 3 mph wind. Oh, if we could only have a 3 mph wind on the prairie!

Thomas Mueller and Alvin Womac, University of Tennessee, evaluated the effect of glyphosate formulation, nozzle type, and spray pressure on droplet size (Mueller and Womac. 1997. Effect of formulation and nozzle type on droplet size with isopropylamine and trimensium salts of glyphosate. Weed Technology 11:639-643). Across the average of three glyphosate formulations sprayed at three pressures the Extended Range nozzle tip reduced the volume of small droplets (less than 191 microns in diameter) to 45%. The Drift Guard tip reduced the volume of small droplets to 32% and the Turbo TeeJet reduced the volume of small droplets to 27%. Increasing spray pressure from 20 psi to 60 psi increased the volume of small droplets from 26% to 42%. Bob Hartzler at http://www.weeds.iastate.edu/mgmt/qtr97-4/glyphosatedroplets.htm has an excellent summary of this article.

Alan Dexter, sugarbeet specialist at U of MN and NDSU published a nice bulletin through the NDSU Extension Service on Herbicide Spray Drift (A-657). In the publication he summarizes the influences of various factors on spray drift (Table 2).

Drift will continue to be a major issue facing agriculture. Paying attention to the above factors can help to minimize drift problems. Good luck and be careful.

Table 1. Influence of droplet size on potential distance of drift

Droplet Diameter (microns)	Type of droplet	Time required to fall 10 feet	Lateral distance droplets travel in falling 10 feet in a 3 mph wind
20	very fine spray	4.2 minutes	1,100 feet
100	fine spray	10 seconds	44 feet
240	medium spray	6 seconds	28 feet
400	coarse spray	2 seconds	8.5 feet
1,000	fine rain	1 second	4.7 feet

Table 2. Influence of various factors on spray drift

Factor	Increases Drift	Reduces Drift
Spray particle size	smaller	larger
Release height	higher	lower
Wind speed	higher	lower
Spray pressure	higher	lower
Nozzle size	smaller	larger
Air temperature	higher	lower
Relative humidity	lower	higher
Nozzle type	produce small droplets	produce large droplets
Air stability	vertically stable air	vertical movement of air
Herbicide volatility	volatile	non-volatile

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CROP NEWS

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

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Cool Temperature and Herbicide Applications

Beverly R. Durgan, Weed Scientist

It seems like we just can't get a break from the weather this year in northern Minnesota. I received several calls this morning about the "light frost" that occured last night. Two factors need to be considered when applying herbicides under cool to frost conditions: Crop safety and weed control.

Crop Safety

If frost injury has occured, such as white or black leaf tips, do not apply a herbicide until the crop has recovered and is showing new growth. Depending on the degree of injury and the weather conditions after the frost, it may take up to a week for the crop to recover. In the case of a "light frost," 2 to 3 days is generally all that is needed.

Under cool conditions, crop injury potential can increase with several herbicides. These herbicides would include:

- *Small grain herbicides: Harmony Extra, Express, Hoelon, Tiller, Cheyenne and Puma*

All of these herbicides can cause small grain crop yellowing, leaf tip burn, and crop stunting when applied under cool conditions. The injury is generally temporary, and the crop will recover when temperatures increase. However, caution should be taken with tank mixes and additive. Also, to decrease crop injury potential, use the lowest labeled rate.

Caution should be used before applying Hoelon to barley under the weather conditions that we are experiencing now. Hoelon has can give severe barley injury under cool conditions. Read and follow the Hoelon label for restrictions on applications on barley.

- *Sunflower herbicides: Assert*

Assert has the potential to cause sunflower injury if the sunflowers have been damaged by frost. If the sunflower plants are showing signs of frost damage, wait at least 3 to 5 days for the plants to recover.

Weed Control

If weeds are showing signs for frost damage, DO NOT apply a herbicide until the weeds show sign of recovering. Delay herbicide applications at least 3 to 5 days.

Under cool weather conditions, herbicides will work more slowly and overall control may be less than under "ideal" weather conditions. Herbicide rates should be adjusted accordingly. It may also be advisable to switch to a herbicide that has greater crop safety.

In This Issue:

Postemergence Wild Oat Control in Small Grains-1999

Beverly R. Durgan, Weed Scientist

Good wild oat control with any herbicide requires proper timing of applications. Postemergence wild oat herbicides require application to wild oats and crops at precise leaf stages. Leaf number on wild oats is determined by counting the leaves on the main stem and disregarding the tillers. The youngest leaf is counted as a full leaf only when another leaf becomes visible. Lower leaves which may have died from various stresses, such as frost or wind damage, should also be counted in the total leaf number. An accurate leaf count is important for optimum wild oat control.

Climatic conditions must also be considered when choosing a wild oat herbicide. One advantage of these cool, wet conditions is that the wild oats are growing well and are not under any stress. Therefore, the postemergence wild oat herbicides should give good control.

There are tradeoffs for the advantages any one postemergence wild oat herbicide might offer. Early wild oat control can mean better yields because the weed has less time to compete with the crop. However, when a herbicide treatment is applied early, odds are greater that a late flush of wild oats will require a second herbicide application, or that some wild oats might escape treatment. Uncontrolled wild oats can reduce yields, and will produce seed that contribute to next year's wild oat problem. Under heavy wild oat pressure (over 15 plants/square foot) research shows that a herbicide treatment should be applied as soon as possible to prevent high yield losses.

Below is a summary of the postemergence wild oat herbicides currently labeled in Minnesota.

Achieve (tralkoxydim):

Achieve recently received a label for wild oat and foxtail control in spring wheat, durum and barley. Spring wheat and durum have good to excellent tolerance to Achieve, however barley tolerance is only fair to good.

Achieve is sold as a 40 DG and the use rate is 0.44 to 0.60 lb/A (0.18 to 0.24 lb a.i/A). Achieve should always be applied with Supercharge adjuvant at a rate of 4 pints /100 gallons of water (0.5% v/v). Apply Achieve to 1 to 6-leaf wild oats.

For broadleaf weed control, Achieve can be tank mixed with MCPA ester, Buctril, Bronate, Curtail M, Stinger, and 2,4-D. DO NOT tank mix Achieve with Harmony Extra, Peak, or any other sulfonylurea herbicides as decreased wild oat control will result.

University of Minnesota research shows Achieve will give good control of green and yellow foxtail and wild oats.

Assert (imazethabenz):

Assert is labeled for wild oat control in spring wheat, durum, and barley. Assert will also control plants in the mustard family, including wild mustard. Spring wheat, durum and barley have good tolerance to Assert.

The use rate of Assert is 1.0 to 1.2 pts/A. For best control, apply Assert when wild oats are in the 1 to 4-leaf stage. Good wild oat control has been obtained when the 1.0 pt A rates have been applied to 1 to 3-leaf wild oats; however, for larger wild oats, the 1.2 pt/A rate should be used. **Assert must always be applied with a non-ionic surfactant at a rate of 2 pts of surfactant per 100 gallons of spray solution.** For control under adverse conditions, such as dry conditions or heavy wild oat pressure, Assert should be applied with a **crop oil concentrate at 2 pt/A in addition to the surfactant. DO NOT** apply crop oil concentrate with 2,4-D ester because of the potential for crop injury.

Assert is also available as a 67% SG formulation. The use rate for the Assert SG is 7.5 to 11.2 oz/A. The 7.5 oz/A rates is equivalent to the 1 pt/A rate of the liquid and 9 oz/A is equivalent to the 1.2 pt/A of the liquid formulation. One container of Assert SG contains enough material for 24 acres at the 1 pt/A rate of the liquid formulation, or 20 acres at the 1.2 pt/A.

Adjuvant selection is very important when using Assert SG. Failure to use the proper adjuvant can result in unacceptable wild oat control (less than 50%). Assert SG should **ALWAYS** be applied with a good quality non-ionic surfactant with at least 80% active ingredient at a rate of 2 pints per 100 gallons of spray solution. For control under adverse conditions, such as dry conditions or heavy wild oat pressure, Assert should be applied with a **crop oil concentrate at 2 pt/A in addition to the surfactant**. SUN-IT II may be used instead of a non-ionic surfactant or instead of a non-ionic surfactant plus crop oil. The rate for SUN-IT II is 1.5 to 2 pt/A. When tank mixing Assert SG with 2,4-D ester **DO NOT** add crop oil concentrate or SUNIT-II because of the potential for crop injury.

Assert and Assert SG can be tank mixed with 2,4-D ester, MCPA ester, Bronate (bromoxynil + MCPA ester), Harmony Extra (tribenuron + thifensulfuron). **DO NOT** tank mix with Banvel (dicamba), MCPA amine, or 2,4-D amine as reduced wild oat control will result.

Assert and Assert SG have soil activity, and may persist for more than one year in the soil. Do not plant any crop other than barley, wheat, corn, sunflowers, soybeans or edible beans for at least 15 months after an Assert application. **DO NOT** plant sugarbeets for at least 20 months following an Assert application. **DO NOT** plant oats, canola, or alfalfa for 15 months after an Assert application.

Avenge (difenzoquat):

Avenge can be used for wild oat control in spring wheat, durum and barley. Barley has good tolerance to Avenge, but some spring wheat and durum varieties will be injured by it. While many new hard red spring wheat varieties were added to the Avenge label last year, there are still several newer varieties not listed. One variety that is not on the regular Avenge label is 2375. However, there is a supplemental label that allows Avenge to be applied to 2375 at 2 ½ to 3 pts/A. See the label for a complete list of hard red spring and durum wheat varieties that have tolerance to Avenge.

Avenge should be applied when the majority of wild oats are in the 3 to 5-leaf stage. In Minnesota research trials, Avenge gave the best control when wild oats were in the 4 to 5-leaf stage. Avenge should be applied at the highest labeled rate when applied to heavy infestations of 3-leaf wild oats, and should not be applied until the wild oats have reached the 3-leaf stage. Use rate for Avenge is 2.5 to 4 pts/A.

Avenge can be tank mixed with 2,4-D, MCPA, Harmony Extra (tribenuron + thifensulfuron), Express (tribenuron), Buctril (bromoxynil), Curtail (clopyralid + 2,4-D amine), and Bronate (bromoxynil + MCPA ester). **DO NOT** tank mix Avenge with Banvel (dicamba).

Cheyenne (fenoxaprop + MCPA ester + thifensulfuron + tribenuron):

Cheyenne is labeled for postemergence control of foxtails and wild oats and most annual broadleaf weeds in hard red spring wheat. Cheyenne **IS NOT** labeled for use in durum wheat, barley or oats.

Apply Cheyenne to spring wheat from the 3-leaf stage to the end of tillering (6-leaf stage). **DO NOT** apply after jointing. Apply when grass weeds are 4 inches tall or less. **DO NOT** tank mix Cheyenne with any other herbicide, additive, or fertilizer.

See the label for mixing instructions. Research at the University of Minnesota shows that Cheyenne will give good to excellent control of wild oats, foxtails, kochia, common lambsquarters, pigweed, and several other annual broadleaf weeds.

There were several cases of hard red spring wheat injury from Cheyenne applications reported last year. The injury is associated with cool, wet weather conditions and late applications. In most cases, the spring wheat recovered from this injury, and there was no yield loss. To decrease the crop injury potential, **DO NOT** apply Cheyenne after jointing stage. Read the label for additional restrictions or precautions.

Hoelon (diclofop):

Hoelon can be applied to all varieties of wheat, barley and durum. Hoelon should be applied when wild oats are in the 1 to 4-leaf stage. For best control, research has shown that Hoelon should be applied before the 3-leaf stage, especially when using the 2 pt/A rate. Hoelon can be applied at 2 to 3.3 pts/A (0.75 to 1.25 lb/A) in spring wheat and durum, and 2 to 2.67 pts/A (0.75 to 1.0 lb/A) in barley. **DO NOT** use over 2.67 pts/A in barley, as barley injury will result.

When using the 2 pt/A rate of Hoelon in spring wheat and durum, the addition of 1 qt/A of crop oil concentrate increases wild oat control. **DO NOT** use crop oil concentrate on barley. When wild oat plants have reached the 3 to 4-leaf stage and/or plants are under moisture stress, the higher labeled rates should be used. Wild oat control with Hoelon is increased by cool temperatures following application.

Wild oat control with Hoelon will be reduced when wild oats are growing under moisture stress. Increasing the rate can somewhat overcome this problem.

Caution should be used before applying Hoelon to barley under the environmental conditions we have had this spring. Hoelon has the potential to give severe barley injury under cool, wet conditions. The Hoelon label states not to apply Hoelon to barley if daily minimum temperatures reach 40°F or less for three consecutive days before application. It also says not to apply Hoelon when moisture content of the field is at field capacity. Hoelon should also be applied to barley before tillering.

It is important to carefully select the proper broadleaf herbicide to tank mix with Hoelon. Many broadleaf herbicides, when tank mixed with Hoelon, decrease the grass control of Hoelon. Hoelon can be tank mixed with Buctril (bromoxynil) or a low rate of MCPA ester (0.05 lb/A) plus Buctril. **DO NOT** tank mix Hoelon with Harmony Extra as decreased wild oat control will occur. **DO NOT** tank mix Hoelon with any other broadleaf herbicide. If a broadleaf herbicide is used, separate the Hoelon treatment and the broadleaf treatment for a minimum of 5 days.

Puma (fenoxoprop + safener):

Puma has recently received a label for wild oat and foxtail control in spring wheat, durum, and barley. Puma contains the same active ingredient (fenoxaprop) for grass control as Tiller and Cheyenne, but because of the addition of a safener in Puma, Puma has good to excellent crop.

The use rate of Puma is 0.33 - 0.66 pt/A. For best control, apply Puma when wild oats are in the 2 to 6-leaf stage. For wild oat control, use the 0.66 pt/A rate. Puma does not contain a broadleaf control herbicide. For broadleaf weed control, Puma can be tank mixed with Buctril (1 pt/A), Bronate (1 pt/A), MCPA ester (0.75 pt/A), Stinger (0.25 - 0.33 pt/A) Curtail M (1.75 pts/A), Starane (0.66 pt/A), Harmony Extra (0.33 oz/A) and Tordon (1 - 1.5 fl oz/A).

Research at the University of Minnesota shows that Puma Cheyenne will give good to excellent control of wild oats and foxtails with good to excellent crop safety for spring wheat and durum. Barley tolerance is fair to good.

Tiller (fenoxaprop + MCPA ester + 2,4-D ester):

Apply Tiller at 1.7 pts/A after the spring wheat and barley begins to tiller (3-4 leaf stage) but prior to jointing stage (6-leaf stage) for wild oat control. Tiller will also control larger foxtail (3-leaf to 2-tillers). In University of Minnesota research, Tiller has given good to excellent control of both yellow and green foxtail. **DO NOT** apply Tiller to durum wheat, oats or rye. **DO NOT** apply more than one application of Tiller per season, or apply within 70 days of harvest. Tiller can be applied by air.

Tiller at 1.7 pts/A is labeled for tank mixing with Stinger, Buctril and Tordon for wild oat control. Check the label for tank mixing restrictions.

There were several cases of hard red spring wheat injury from Tiller applications in 1998. Spring wheat tolerance to Tiller is good to fair. Barley tolerance to Tiller is only fair. The injury was associated with cool, wet weather conditions and late applications. In most cases, the spring wheat recovered from this injury and there was no yield loss. To decrease the crop injury potention, **DO NOT** apply Tiller after jointing stage. Read the label for additional restrictions and precautions.

Timing Of Postemergence Corn and Soybean Weed Control

Jeffrey L. Gunsolus Extension Agronomist / Weed Science

Life has been interesting this spring, making for limited opportunities for fieldwork. I hope that by the time you read this the sun is shining and the winds are calm. What follows is a review from last winter's educational programs on postemergence corn and soybean weed control.

The growth of weeds, as is the case for most biological organisms (e.g., teenagers), is logarithmic. Growth starts slowly but soon occurs rapidly. Effectiveness and crop injury problems can be attributed to herbicide application to weeds and crops that are too large. Most postemergence herbicide labels list the ranges of weed and crop heights over which herbicide effectiveness will be maximized and crop injury will be minimized. With the advent of herbicide-resistant crops, the concern over herbicide-induced injury to larger crop growth stages has been reduced but not eliminated if you are tank mixing with other herbicide modes of action (e.g. plant growth regulators). However, the need for a timely herbicide application to maximize effectiveness and to minimize weed-crop interference is important. For example, in the Roundup Ready corn system, the glyphosate label states that the herbicide should first be applied when weeds are 4 inches in height. In the Roundup Ready soybean system, the glyphosate label states that weeds should be controlled in the 4- to 8-inch height range. Experience has taught us that translating weed height into units of time (i.e., days after crop planting) helps growers integrate weed and crop biology restrictions into their time and labor framework. Under most Minnesota spring and early summer cropping conditions it takes approximately four weeks for foxtail to reach 4 inches in height and approximately six weeks for the foxtail to reach 8 inches in height. Therefore, based on the glyphosate label, a Minnesota crop producer has about a two-week interval to complete a glyphosate weed management program in soybean, and a glyphosate weed management program in corn should be initiated approximately one month after corn planting when foxtails are 4 inches tall. Disruption of the time of application framework could mean poor weed control or yield loss due to weed-crop competition.

Based on current cropping conditions, it is important to be ready to apply postemergence grass herbicides in corn as soon as the grass weeds approach 3 to 4 inches in height. For fields where the corn is still under 5 to 11 inches in height, some of the preemergence herbicides can still provide some residual weed control and reduce the need to treat all fields in such a timely postemergence manner.

For more details on delayed preemergence herbicide applications in corn see page 13, paragraph 27 of *Cultural and Chemical Weed Control in Field Crops* (MN Extension BU-3157). This can also be accessed at http://www.agro.agri.umn.edu/appliedweeds/. Click on Extension Publications.

1999 Ag Professional Field School

Kevin Cavanaugh, IPM & Ag Professional Program Coordinator

The 1999 Ag Professional Field School will offer two sessions, both to be held at the Southwest Research and Outreach Center-Lamberton. Session I will run from July 13-14 and Session II from July 15-16. Both sessions will be identical in content.

This is a hands-on, in-field program emphasizing corn, soybean and alfalfa management skills. Participants will enhance their troubleshooting and crop management skills in specially designed plots that display actual cropping situations. The Field School is targeted towards chemical/fertilizer/dealers, seed dealers, crop consultants, crop production specialists, agronomists, and county Extension educators. A total of 12 CEU has been requested for this program. Each session will offer Soil and Water Management (2.5 hr), Pest Management (7.0 hr), and 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 28, 1999. To receive a program brochure and registration information, contact Tracey Benson at (612) 624-3708 or 800-367-5363. If you have questions about program content, contact Mike Schmitt at (612) 625-7017 or Kevin Cavanaugh at (612) 625-2778.

Session I & II, July 13-16
General session topics and instructors will include:

- **Soils Properties and Crop Production**, John Lamb, Mike Schmitt, Neal Eash, Neil Hansen, Jeff Strock, Carrie Laboski-University of Minnesota; Bob Schoper, Farmland Industries.
- **Weed Identification**, Beverly Durgan, Krishona Bjork-University of Minnesota.
- **Field Crop Diagnostics**, Lee Hardman, Dale Hicks, Paul Porter, Kevin Cavanaugh, Rich Kvols, Tim Arlt, Lisa Behnken, Bruce Schwartau.
- **Weed Management**, Jeff Gunsolus, Gregg Johnson, Tom Hoverstad-University of Minnesota; Eric Spandl-Cenex/LOL
- **Entomology**, Ken Ostlie, Bill Hutchison, Eric Burkness, Bruce Potter-University of Minnesota.

Supplemental Nitrogen Will Reduce Agronomic Risk for Many Corn Growers

Michael Schmitt, Extension Soil Scientist and Gyles Randall, Soil Scientist

It would be prudent for many corn growers (especially those who applied N last fall) to make plans for making supplemental N applications this season. With fall-applied N, the culprits for N loss were the fall conditions that lasted until mid December and our wet April and May. Last fall's N management practices will be critical in determining the need for supplemental N. Although the majority of spring-applied N should be fine, there probably have been some losses when N was applied as urea or UAN-28 on medium- to coarse-textured soils in April. With either fall- or spring-applied N, the losses are from both denitrification and leaching.

Some common questions being asked:

Should I be concerned even if I followed N BMPs for their respective areas?

Yes, the good of the BMPs cannot overrule the curse of mother nature this year. Even best management of N would create a cause for concern right now. For fall N applications, only anhydrous ammonia applied with a nitrification inhibitor after November 1st would not require a supplemental N recommendation. Losses will be greater when the N was applied earlier in the fall and where urea was used. With April N applications made using urea or UAN-28 in southeast, east central and central Minnesota, leaching may be moving N downward, possibly out of the effective rooting zone for this summer. All spring N applications with anhydrous ammonia are not a concern at this point in time, although this could change.

What application rates are the U of M suggesting?

The rate of supplemental N will be somewhat dependent on each field's potential N losses. Thus, Table 1 reflects fertilizer N management (time of application, N source) and region of the state. Research work in Minnesota as well as other cornbelt states provide a basis for these recommendations. If a nitrification inhibitor was used with late October or November applications, the supplemental N recommendation can be adjusted downward by 20 lbs/A. For spring N applications of urea or UAN-28, 30 and 20 lb N/A is recommended for southern and northern Minnesota, respectively.

How should supplemental N be applied?

Supplemental N application options listed in order of agronomic preference are: 1) Sidedress anhydrous ammonia between now and the end of June. Anhydrous will provide greater stability if N loss conditions continue. Using an applicator with knives on 60-inch centers is very acceptable. 2) Urea topdressed to corn will also be feasible. While some urea granules will land in the whorls and create tissue burn, this damage is only cosmetic and not yield limiting. We recommend incorporation of urea with a cultivation pass. 3) Applying UAN-28 to the soil followed by cultivation will also work.

Would a PSNT soil test be helpful?

An in-season N test will not provide a great deal of insight regarding N losses. Even in normal years this management strategy confirms N sufficiency rather than predicting N deficiency. Minnesota research does not find a good correlation between nitrate-N measured and supplemental N needs. Thus, we suspect that this test will not be extremely useful this season.

What about manure/alfalfa N credits?

Corn fields that are following alfalfa or have had significant manure applications are less prone to N losses than those fields receiving fertilizer N. Alfalfa and manure contain significant organic N contributions, which are immune to denitrification and leaching, and manure's inorganic N often gets immobilized during the early spring months, thus, N loss is less when alfalfa/manure is part of the management scheme.

Will the U of M Supplemental N Worksheet work?

The Supplemental N Worksheet will work, but we think that contingency plans need to be made sooner rather than later this spring. We believe conditions are such right now with fall-applied N that supplemental N recommendations can be made and the worksheet can be used. But because of the slow growth of corn, it will be most useful later in June. If wet soils continue into early June, spring N applications can be best assessed using the Supplemental N Worksheet starting in mid June. We will post the U of M Supplemental Worksheet in next week's Crop News.

Table 1. Suggested supplemental N recommendations for corn as affected by N management and location within state, 1999.

Fertilizer N Management		Region of State	
Application Date	Product	South of Hwy 12	North of Hwy 12
		Supplemental N (lb/A)	
Before Oct. 15	Anhydrous Ammonia	50	30
	Urea	70	40
Oct. 15 - Nov. 1[1/]	Anhydrous Ammonia	40	20
	Urea	70	40
Nov. 1 - Mar. 1[1/]	Anhydrous Ammonia	30	0
	Urea	60	30
Mar. 1 - April 30	Anhydrous Ammonia	0	0
	Urea/UAN-28	30	20

[1/] Supplemental N recommendations can be reduced by 20 lbs/A if a nitrification inhibitor was used.

Nutrients in Surface Runoff

George Rehm, Extension Soil Scientist

Recently, a lot of concern has been focused on plant nutrients and the quality of surface waters. The loss of phosphorus and ammonium-nitrogen to these waters receives special attention.

The loss of plant nutrients in surface runoff has been a concern of researchers involved with crop production for several years. Studies have focused on developing management practices that might reduce these losses. Tillage system has a major effect on soil loss and, therefore, has substantial impacts on losses of ammonium-nitrogen and phosphorus. A study from Kentucky shows the impact of tillage system on loss of ammonium nitrogen and phosphorus from the landscape. The results of the research are summarized in the table below.

For the conventional system, the soil was plowed to a depth of seven inches and disked twice. A straight shank chisel and light secondary tillage operation was used for the chisel-plow treatment.

The difference in soil loss as affected by tillage system were substantial. Since most of the ammonium nitrogen and phosphorus lost from a landscape is attached to soil particles, the higher losses of these nutrients in the conventional tillage system would be expected.

This study shows that residue left on the soil surface can reduce losses of plant nutrients from fields. The use of no-till practices on all acres, however, is not necessary. The chisel-plow system that is popular in much of Minnesota can also reduce nutrients lost in surface runoff.

Table 1. Effect of tillage system on soil, ammonium-nitrogen, and phosphorus from soil with a 9% slope.

Tillage System	Soil Loss	Nitrogen Loss	Phosphorus Loss
		lb./acre	
Conventional	13,826	1.16	.62
Chisel	2,944	.62	.36
No-till	268	.45	.27

Losses reported in this table were measured after three rainfall events and are not intended to represent losses during an entire growing season. Actual losses measured will be affected by several factors. Therefore, the relative comparisons are important.

Sunlight Helps Narrow-row Corn and Soybeans

Denise McWilliams, NDSU/UM Crop Production Specialist

Day length and light interception promote yield in both corn and soybeans, especially in narrow-rowed crops as shown in both Minnesota and North Dakota. In 1996 and 1997, row-spacing studies were conducted on dryland corn near Mandan, ND. Corn was seeded into wheat stubble in rows 7.5, 15 and 30 inches apart. The two-year average was about equal for the two narrower spacings. Both narrow spacings were 27% greater than the 30-inch spacing that only averaged 90 bushels per acre. Planting in narrow rows (less than 20 inches) may be beneficial in years when ample soil moisture and plenty of sunlight allow the narrow-row system to optimize yields in the Valley. However, both sunlight and moisture are very important. In soybeans, a similar scenario is also true, with narrow rows often resulting in better yields under optimum field conditions. Too much moisture throughout the season, unfortunately, can minimize yield gains in narrow rows. Corn and soybean diseases can result from too much soil moisture in either warmer or cooler than optimum conditions. Difficulty cultivating in narrow-rows also limits tillage use for drying out fields and for weed control which may also limit yields in narrow rows. Evaluate soil type and general conditions within a field before converting to narrow rows for corn and soybeans.

Thistle Control in Corn and Soybeans

Denise McWilliams, NDSU/UM Crop Production Specialist

Thistle, especially Canada thistle, is showing up in corn fields in the Valley due to the ample moisture that has insured germination. Combining both mechanical and chemical controls will limit the bite the weed have on crop yield. Cultivate fields early, before the 3-inch weed stage if possible, and continue routine field scouting and cultivating as needed to prevent thistle bolting. Clopyralid (Stinger) provides good chemical control. The weed may also be suppressed with atrazine, bentazon (Basagran), dicamba (Banvel, Clarity or the new combo compound, Distinct, dicamba + diflufenzopyr) or 2,4-D amine. Dicamba will give more consistant control than 2,4-D with less risk of corn injury. Long-term control of thistles depends on using an integrated management program such as the use of both mechanical and chemical controls. Timely applications of chemicals will maximize control of current thistles and will help to reduce weed seed banks and root reserves of the thistles.

Control of Canada thistle in soybeans is difficult but measures can be taken to suppress the weed in the Valley.

(continued on next page)

Cultivation of the weeds early in the season will limit thistle competition to crop yield. Cultivate fields this season to control thistles and to aerate previously saturated soils for better crop growth. Chemical control can be integrated into your weed management program by using bentazon (Basagran or Rezult). However, as suppression is the best expectation with the limited chemical control available in soybeans, a second application will help on high weed populations if the spray is applied 10 to 14 days after the first application. Once thistle invades a field, multiple control strategies should be implemented. An integrated management program is most effective in reducing weed seed accumulation and in depleting weed root reserves. Also, don't forget where the weed populations reside in the field. In the fall, glyphosate, clopyralid, 2,4-D and dicamba or a combination of some of these herbicides will provide further weed control if applied prior to a killing frost and when soil moisture is good.

Roundup Ready Reminders for Soybeans

Dave Schwartz, Extension Educator - Soybean Production

Roundup Ready soybeans are generally in their third year of production in Minnesota. This is still a new weed control concept for many growers so producers are asking questions and experimenting with rates and timing of the application. Here are things producers need to remember when making roundup ready decisions this growing season.

- Roundup Ultra and Roundup Original are the only formulations of Glyphosate labeled for use on Roundup Ready Soybeans.
- Remember that annual grass weeds are easier to control with Roundup than are annual broadleaf weeds, and annual broadleaf weeds are easier control to control than perennial weeds. Annual weeds are controlled easiest with Roundup when they are young.
- Perennial weeds should be sprayed when they are in the bud to early flower stage for best long-term control.
- Soybeans tolerate early weed pressure better than corn. If wet weather delays herbicide spraying, corn fields should be sprayed (with any post-emerge herbicide) before soybean fields if weeds are at the same stage of growth.
- RATES-Monsanto is offering their technology value package, which it appears many growers will adopt. In conventional tillage, growers who use 32 ounces per acre on 4-8 inch weeds are eligible for 12 ounces of Roundup Ultra free if a minimum of 24 ounces is re-sprayed.

If the crop is under moisture stress, plan the first application for weeds in the 4-6 inch stage. On the other hand, the application can be delayed to the 6-8 inch stage if soil moisture is good. When the most difficult annual broadleaf weeds-waterhemp, velvetleaf, Pennsylvania smartweed, and black nightshade-exceed 6 inches in height, growers should increase rates of Roundup Ultra from 24 ounces to 32 ounces and increase the rate to 48 ounces when these weeds, exceed 12 inches. Ridge till farmers who apply very low rates preplant or at the cracking stage may experience better weed control by avoiding early morning and evening sprayings.

- Weeds such as waterhemp and black nightshade germinate late in spring so a delayed or second application is necessary if these types of weeds have a field history.
- Ammonium sulfate (AMS) is an insurance policy for optimum weed control. Studies show AMS improves weed control of tough-to-control weeds under adverse weather conditions—either droughty or cold temperatures (less than 55 degrees F). AMS also appears to improve weed control when spraying with hard water testing more than 500 ppm. When mixing the spray solution, ammonium sulfate should be added before Roundup Ultra to the tank.
- Annual weeds are normally more competitive with the crop than perennial weeds. In a Roundup Ready management plan, annual weeds should be the first priority in the timing of the application.
- One application of Roundup Ultra should be enough if growers are solid seeding soybeans.
- Last but not least, make sure fields to be sprayed with Roundup are Roundup Ready soybean varieties.

Plant Disease Clinic

Sandra Gould, Assistant Scientist

Samples submitted to the Plant Disease Clinic in May included:
corn—cultured for storage molds
barley—tested for loose smut
alfalfa—Fusarium sp root rot, Spring black stem (Phoma sp)
wheat—cultured for storage molds
red oak—Oak wilt
turf—pink snow mold(Fusarium sp)
geranium—Xanthomonas campestris pv pelargonii (bacterial wilt), Pythium sp root rot
dahlia—Dahlia mosaic virus
lamium—Phytophthora sp
hepatica—Meloidogyne hapla (root-knot nematode)
impatiens—Impatiens necrotic spot virus(INSV), Alternaria sp leaf spot
canna—bacterial leaf blight
petunia—TMV(tobacco mosaic virus), Petunia vein clearing virus
mum—INSV
rose—Apple mosaic virus, Prunus necrotic ringspot virus

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MINNESOTA

CROP NEWS

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

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Daily Crop "ET" Available on Internet

By Jerry Wright, Extension Engineer

Producers and crop consultants in Minnesota needing daily crop water who use "ET" information for irrigation scheduling can access the Internet for daily ET potentials presented on color contoured statewide maps by linking to one of the following websites:

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

North Dakota & Red River Valley (ETs for several crops):
http://www.ext.nodak.edu/weather/cropwater/

The Minnesota and Wisconsin ET daily statewide map is updated seven days a week and gives only the potential daily crop ET (also called reference ET) values across the state. These estimated ET values are very similar to the daily ET rate from a full cover alfalfa crop at 6 to 10 inches in height. The estimated daily ET value for a given field location can also be sent directly to an Internet user by e-mail each day if requested over the website.

The daily WI-MN ET maps are created and managed by University of Wisconsin Extension Soils Scientist, Bill Bland. To estimate the daily ET for different crops the reported daily potential 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 this Kco value may become slightly larger (to around 1.1) during a crops' critical growth period, like with corn between late pollination and early dough stages.

The reference ET daily contour maps are generated using daily climatic measurements from local automatic temperature recording stations (like at airports) across the state and a US-GOES satellite that takes a picture of the cloud cover about every 10 minutes to estimate the daily solar radiation for a given location. Comparing the 1998 ET estimations to local weather station estimations at Staples and Morris found them to be about 10 percent greater in value than reported by local ET hotline services.

Keeping track of the crop's daily ET use and regularly checking in-field soil moisture can help an operator optimize crop growth while reducing the potential for leaching of crop inputs like nitrogen into the groundwater.

These daily ET values best serve the user if recorded on a calendar log like an irrigation checkbook worksheet or computer spreadsheet for quick reference when making your irrigation decisions. Consider assigning the calling task to one of the younger members of your family.

For more information about using daily crop ET information, contact Jerry Wright, Extension Engineer at the West Central Research and Outreach Center in Morris, MN (320) 589-1711 or jwright@tc.umn.edu or your local Extension or SWCD office.

In this issue

Delayed Planting of Small Grains

Jochum Wiersma, Small Grains Specialist

The recent rains are delaying field work and planting of small grains. Wheat, barley and oats are all cool season grasses which suffer yield losses as planting is delayed beyond the optimum window. The reduction in yield potential is the result of the shortened growing season. The crop will go through its development faster producing fewer tillers, smaller heads, and fewer and smaller kernels per head. Oats is most affected by delayed planting followed by barley then wheat. In addition to lower yield potential, test weight will suffer and the crop may be pushed to maturity faster due to higher temperatures during grain fill.

Yield trial data indicate that yield will decrease by 1% per day once the optimum seeding dates have passed. To counteract the effect of reduced yield potential, farmers should increase their seeding rate by 1% per day after the optimum seeding date has passed. This increase in seeding rate will in part compensate for the reduction in tillering and the smaller heads. The optimum and last possible seeding date are listed here:

South of the line from:	Optimum	Last Planting Date:
Fergus Falls to Breckenridge - MN Highway 210	Third week of April	Second week of May
Detroit Lakes to Moorhead - US Highway 10	First week of April	Third week of May
Mahnomen to Halstad - MN Highway 200	First week of May	Fourth week of May
Grand Forks to St. Hilaire	Second week of May	First week of June
Canadian Border	Second week of May	First week of June

Replanting Decisions for Small Grains

Jochum Wiersma, Small Grains Specialist

Wet weather has left earlier planted fields saturated and with ponds across lower areas. The germinating seeds and young seedlings are vulnerable to this excess of water. The saturated soils will create anaerobic conditions that promote seedling diseases. Standing water itself can kill plants. Evaluate the stands as soon as field conditions allow. Seedlings may appear healthy with the cool weather but if the root system is affected, the plant is likely to die later when temperatures increase. Healthy seedlings should have a white root system and germinating seeds should appear clean and not soggy and watery.

Replanting of small grains is not an easy decision as late planted crops have a large disadvantage and yield potential is reduced. A stand of 15 to 18 plants per square foot is likely to outyield a late planted stand of 30 plants/square foot simply because tillering will reduce the impact of the lower stand.

If the stand loss is concentrated in lower areas of the fields, replanting is only beneficial if areas are large enough to warrant replanting, knowing that the crop will not develop and mature at the same rate and time as the rest of the field and that you need to manage the fields differently.

Canola is Late for Some Farmers

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

Canola, which was planted early before the heavy rains, has crusting problems in some fields or may have been planted too deep due to soil conditions, making plant emergence difficult. Areas even less optimistic face late planting or no planting of canola. South of Highway 94, planting will probably proceed until May 20 when warmer temperatures make planting or replanting unwise. From Highway 94 to Highway 2, many farmers can consider planting canola until May 25. More northern areas can plant through Memorial Day and possibly into the first week of June. Recognize that later planting dates will result in lower yields. Spring canola is very sensitive to heat and drought during flowering. Pushing planting dates beyond May 15 places the plant into less optimum conditions during flowering. Also, cool, wet weather during the growing season promotes green seed problems in canola at maturity. Choose fields with better surface drainage and fertility. Seed as early as possible. Plant at the correct depth and have good seed to soil contact for quick and even emergence. Monitor fields for flea beetles and white mold.

Predicted Emergence for Weed Seedlings

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

According to a weed emergence model called WEEDCAST developed by the USDA in Morris, MN and used by NDSU weed scientist, Dr. George Kegode, estimates on some of the common species around the Valley region can be predicted. The model is set to predict emergence under various conditions (tillage, previous crop, soil type and soil moisture). Under chisel plowed land, which was previously under wheat on a Fargo clay soil under very wet field conditions, the model as of May 10, has predicted the following:

Weed (common name)	Emergence (%)	Size (inches)
Green Foxtail	23	0.21
Yellow Foxtail	13	0.22
Redroot Pigweed	25	0.05
Common Lambsquarters	36	0.20
Pennsylvania Smartweed	58	0.05
Nightshade (black)	12	0.05
Common Cocklebur	54	0.61
Kochia	81	0.12

Late Planting or Replanting of Corn and Soybeans

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

If planting after May 20-25 in the southern Red River Valley, consider switching to a hybrid that is five to seven days earlier than your region's adapted full-season hybrid and try to get all corn in before the end of May. The switch to earlier hybrids is not as much for yield (late planting already has losses), but to reduce the risk of having immature or wet grain in the fall. The risk is simply the gamble on total growing degree days for the season, the estimated first fall frost date which will end the season and how cooperative fall drying conditions will be for the corn.

If uneven emergence in corn is scattered and infrequent from row-to-row, replanting probably won't increase yield. If the emergence of corn is less than two weeks after planting, replanting will probably not increase yields more than five percent. However, if the cool soil and air conditions have slowed corn emergence, carefully evaluate the stand and determine if replanting would help. Stands emerging three weeks or later that are replanted within the optimum planting window, can increase yields up to 10%. This year, however, increased precipitation and cool soil temperatures moving up from the depths of the soil profile have slowed corn emergence and limited reentry into fields. Look carefully at your economic return toward increased yields compared to replanting costs as well as the risk of emergence problems with a late replanted stand before deciding to replant corn.

If soybeans were planted early in the Red River Valley (before the heavy rains), surviving seedlings may show germination and emergence delays. Fungicide use may have helped prevent early disease in the cool, wet soils and increased seeding rates may have maintained populations to reasonable levels; however, root diseases are still a concern in soybeans. Phytophthora and Rhizoctonia are two diseases that may cause seedling damage or death. Timely cultivation can help dry soils in the upper surface and reduce root rots while promoting root development this year. Consider cultivation in any late-planted soybeans, too. Try to plant (or replant) soybeans before the end of May. Full-season varieties can be planted through June 10. After June 10, switch to an earlier (0.5 maturity unit less) seed. The risk to yield is greater in all June plantings due to yield losses from a shorter season and later pest problems. Shifting to shorter-maturing varieties sacrifices yield, but limits risk from an early frost that reduces both yield and quality.

As if late planting and replanting is not bad enough, USDA estimates recently reported the bad and the really bad news for corn and soybean farmers. The bad news is that corn prices are pedicted to stay in the $1.80 to $2.20 range. The really bad news is for continued decreases in soybean prices because of expected record production in this crop.

Spring Rains and Preplant Nitrogen for Corn

Michael Schmitt, Extension Soil Scientist

Many people are questioning the fate of their N from applications made either last fall or earlier this spring. The question of N loss, either from denitrification or leaching, is most prevalent. We are still a couple weeks too early to conduct our Supplemental N Worksheet exercise, as a lot of things could happen between now and the June window of sidedressing. The soil moisture conditions AND the corn growth in the next couple weeks will be crucial in our final recommendation for possible N additions.

The cooler soil temperatures have limited N loss. Remember, both nitrification and denitrification are (primarily) biological processes and the cooler soils limit their magnitude. We still may have large N losses when the soil warms if soils remain saturated. However, if the rains subside and the soil drains, significant N losses are not imminent.

More of an immediate concern to producers will be those field depressions where water was standing for quite a while with small corn plants trying to grow. The initial reaction will be to think that the corn is looking so poor due to N deficiency. Be careful, corn roots cannot thrive well in a waterlogged situation and the poor corn growth could be due to anoxic (oxygen starved) conditions for the roots. If you dig up a few plants and notice an underdeveloped root system and few root hairs, this is not from a lack of N!

Stay tuned as the issue of N loss and possible supplemental N recommendations are still ahead!

Crop Rotation Pays

Dave Schwartz, Extension Educator

A common concern of many growers in the Midwest is to find a profitable third cash crop, other than corn and soybeans. It's especially a concern when grain prices slump like they have over the past 12 months. Peas, sweet corn, small grain, sugar beets, alfalfa, and edible beans are options in some areas but most growers would agree farmers in the Midwest lack a consistent profitable alternative to corn and soybeans. Why is crop rotation important?

Crop pests populations increase rapidly when only one or two crops are planted year after year. One of the best current examples of the value of crop rotation is soybean cyst nematode. This pest has adapted to the corn soybean rotation and over time, populations have risen to the level where soybean yields are suffering.

SCN has established itself in much of southern and western Minnesota where the most common crop rotation for 15 to 20 years has been corn-soybeans. Alfalfa and small grain were replaced in the crop rotation when dairy farms disappeared from these areas.

Another pest that has adapted well to our current cropping pattern is the corn rootworm beetle. It has now developed a disapause stage the year soybeans are normally planted. Pests adapt well if growers fall into a similar management plan of the same crops, chemicals, tillage, etc., year after year.

Long-term studies done by the University of Minnesota in the late 70s and 80s found a 10% - 15% increase in corn and soybean yields when the crop was planted in a two-year rotation over continuous corn or soybeans (Table 1). Growers can expect an additional 4-5 bushels of soybeans per acre if soybeans are planted every three years rather than planted in two year rotations (Table 2).

Pests such as mites, nematodes, weeds, insects, diseases, all reduce grain yield. Most types of pests are kept in check if the "rotation philosophy" (not just crop rotation) is used in all parts of the crop management plan. Rotating herbicide families, tillage systems, fungicides, and insecticides, are all management practices that reduce pest pressure and should result in better yields.

Table 1. Crop Rotation Effects on Corn and Soybean Yields (1986-1989).

Rotation	Yield	Difference
	(bu/A)	
Corn Yield		
Continuous corn	129.0	---
Corn-soybean	144.0	15.0
Soybean Yield		
Continuous soybean	41.1	---
Corn-soybean	48.8	7.7

Table 2. Effect of Rotation on Soybean Yields Over 3 Years at Waseca

Rotation	1978	1982	1984	Avg.
		(bu/A)		
Corn/soybean	56	36	36	42
Corn/corn/soybean	58	44	40	47
Difference	2	8	4	5

Should Poor Stands be Filled?

Denise McWilliams, NDSU/UM Extension Crop Production Specialist

A quick rule of thumb during optimum planting windows for corn and soybeans is that if stands are only a 3/4 stand or less, you can either tear up the stand and replant or fill-in the existing stand and create uneven emergence. Within two weeks of the original planting, filling-in is an option as yields should still be very similar to those from a uniformly emerging stand (if relatively uniform spacing can still be maintained during planting). However, this two-week window of opportunity is short and may be too early to determine if the stand will be poor.

Waiting three weeks after initial planting can be best, but yield potential this late after the initial planting is about 10% less than if you tear up the field and start over with an even-emerging stand. This year, heavy precipitation over much of the North Dakota/Minnesota Valley will not allow the luxury of these simple replant decisions. Carefully compare any possible yield increase (or decrease) in corn or soybeans against probable tillage, seed, pesticide, labor and dryer fuel costs with replanting.

Minnesota Farm Assistance Program

Kent Thiesse, Extension Educator

Most Minnesota farmers will receive sign-up forms and information for the Minnesota "Farm Assistance Program" during the week of May 24-29.This program is the result of the $70 million dollar Farm Relief Package passed by the State Legislature in April. The program is being administered through the Minnesota Department of Revenue. This is a state program and not a federal farm program, so County Farm Service Agency (FSA) offices will not provide information or answer questions on the program.

The Farm Assistance Program is for farm operators and not for landlords who rent out their land. The mailing that farm operators receive will contain the application form (Form AG-1), application instructions, and a return envelope. The mailing will also include a letter from the FSA office that verifies "effective agricultural use acreage" for the 1998 crop year. This is the acreage that will be eligible for the Program. Applications will be accepted after May 31, 1999, and payment can be expected within 30 days after the completed application is received.

Farm operators may be eligible for one of two types of assistance under the Farm Assistance Program:

Option A: Refund of property tax for livestock facilities on 160 acres or less. (Refund is on property taxes due and payable on May 31, 1999 on qualified agricultural homestead property).

Option B: Per acre payment of $4.00 per eligible 1998 crop acre. (Based on the "effective agricultural use acreage" in the FSA Letter.)

***NOTE:** The maximum payment per farm operator or per farm is $5,600.00.

Most farm operators will qualify under Option B, the $4.00 per acre payment. This application process will be fairly simple for most farmers. They will need to complete one Form AG-1 and attach a copy of the FSA letter for each farm number listed in the FSA letter. The completed application is mailed to the Department of Revenue. The deadline to apply for Option B is September 30, 1999.

Option A is for livestock producers who operate a livestock facility on 160 acres or less. The livestock operation must be on agricultural homestead property and must have produced at least $10,000.00 in sales of unprocessed livestock or dairy products, according to income tax records for 1997 or 1998. The property tax refund is on the taxes that were due and payable on May 15, 1999. Any leased or rented acres do not qualify for Option A.

To apply for Option A, farmers need Form AG-2, "Certification For Agricultural Assistance," from the county auditor's office. The farmer completes the top portion of Form AG-2, then returns it to the county auditor to complete the form and determine the property tax refund amount. The completed form and all other necessary documentation are sent to the Department of Revenue. The deadline to apply for Option A is November 30,1999.

All county offices of the University of Minnesota Extension Service have fact sheets available to assist farm operators with the Farm Assistance Program. Technical questions about the program should be referred to the Minnesota Department of Revenue (1-800-652-9094). Specific questions about property tax refund eligibility can be handled by county auditor's offices. Remember, County FSA offices are not administering the program and cannot answer questions about it.

Weed Identification

Kevin Cavanaugh, Weed ID, Dept. of Agronomy & Plant Genetics

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

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

- **DO NOT** place weeds into plastic bags or wrap in plastic wrap. The plants will turn to mush.
- **DO NOT** tape weeds to paper or manila folders. Put the plants in a fold of a paper towel or newspaper. Press overnight under a heavy book and mail them in the paper. If necessary, plants can be folded to fit into the envelope.
- Mail all plants samples at the beginning of the week to avoid having them sit in the post-office over a weekend.
- Send an identifiable portion of the plant. This includes the top growth of the plant with 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.

Information on weed management, herbicide application, and timing is available in the University of Minnesota Extension Service publication (BU-3157-S) Cultural and Chemical Weed Control in Field Crops-1999, available in county Extension offices.

Homeowners WEED ID: Follow the above suggestions for sending samples in for identification. The Yard and Garden Clinic charges $5.00 for identification. Samples sent incorrectly to me will be given to the Yard and Garden for identification.

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

Black Cutworm Infestations Imminent

Ken Ostlie, Extension Entomologist

Black cutworms are migratory moths that migrate north from Texas and Mexico each spring with strong weather systems. Because the number, timing, and path of these weather systems vary each year, black cutworm flights are unpredictable. Since 1986 these flights have been monitored by a network of pheromone traps. Minnesota is on the northwest corner of the typical migratory route but not this year. Weather systems over the last three weeks have brought 3 major flights into Minnesota. Traps reporting significant captures (over 8 moths in two nights) in each flight are reported below.

Flight	Arrival dates	Counties
1	April 24-May 1	Faribault, Freeborn, Mower
2	May 2-3	Pipestone, Stevens
	May 4-6	Martin, Mower, Blue Earth, Waseca, Rice
	May 6-8	Steele, Carver
3	May 10-13	Lac Qui Parle, Renville, Redwood, Martin, Faribault, Freeborn, Waseca, Steele, LeSueur, Rice, Scott, Dakota

These traps provide only a rough indication of geographic area likely to be affected. Infestations may appear in adjacent counties.

Feeding injury to emerging corn typically begins at about two weeks (150 degree days base 50°F) while cutting first appears about 3 weeks (300 degree days) after a flight's arrival. Cooler weather over the last 10 days will slightly delay cutting activity but predicted cutting dates for each flight are as follows:

Flight 1	May 21
Flight 2	May 26-29
Flight 3	May 31 - June 3

Scout fields for feeding holes on leaves and fresh cutting of plants or leaves. The best time of day to scout is in the morning before freshly cut leaves or plants wilt and blow away. The culprit larvae can typically be found near the plant in the soil, under soil clods or under crop debris. Note: Small larvae can be notoriously difficult to find in wet soil. Examine cutting closely. Cutting at or above the surface poses little threat, since the growing point is well below the soil surface, but make a decision if cutting is below the soil surface.

Risk of infestation is related to presence of crop residue on the surface, which attract the newly arrived females for egg laying. Infestations are spotty but the following generalizations may guide your scouting:

- Soybean residue is preferred over corn residue.
- Fields worked before the flight arrives have a reduced risk.
- Ridge tilled corn and corn no-till planted into soybean residue have greater risk.
- Corn is generally of greater concern than soybean but both crops may be attacked.

Fortunately, the significant progress made in corn planting before these flights arrived will diminish the threat.

Treatment is recommended if stand loss is likely to exceed 3% and larvae are still small enough (< ¾") to achieve more than revenge. Cutworms are easy to control with rescue applications of Asana, Ambush, Lorsban, Pounce, and Warrior.

A number of other cutworm species occasionally wreak havoc in Minnesota, including sandhill, dingy, glassy, darksided, redbacked, claybacked and variegated cutworms. Most of these cutworms overwinter in Minnesota so damage appears earlier than that of black cutworms. To avoid unexpected infestations, monitor all corn from emergence to V4.

Several crop consultants in western Minnesota report black cutworm moths commonly observed in fields while scouting during the last week. I have never heard reports like this before so watch fields closely in the next few weeks. For up-to-date information on black cutworm flights and management, see www.ent.agri.umn.edu

Early Development of Tan Spot

Jochum Wiersma, Small Grains Specialist

Dr. Marcia McMullen, NDSU Extension Plant Pathologist has confirmed the presence of tan spot in several wheat fields in the northeastern part of North Dakota. The tan spot was both present on winter wheat as well as very young seedlings of spring wheat. Unlike the typical necrotic lesions that develop as the disease progresses, these very early infections showed small tan to redish lesions. The disease is most likely to occur where wheat was planted into wheat stubble. The wet weather has favored the development and spread of the disease.

Consider tank mixing a fungicide with the application of your herbicide if your winter wheat is in the 4 to 5 leaf stage and the canopy is closing. Both a 2 oz application of Tilt as well as the different formulations of Mancozeb at the 1 lb rate are labeled for early control of foliar diseases, including tanspot.

Rohm and Haas Company has entered the market with a more rainfast mancozab formulation called RainShield. The cost of this Rainshield formulation is about 5 cents more per pound than the regular Dithane DF, but this new formulation does not require the addition of a spreader sticker.

Increasing Farm Income - (with CREP)

Gary Wyatt, Extension Educator, Watonwan County

The severely low prices of agricultural commodities have caused farm families to seek other forms of income while trying to reduce expenses without affecting profitability of agricultural enterprises.

One of the opportunities for farm families to increase income is to look at the conservation incentive programs being offered by the SWCD (Soil and Water Conservation District), NRCS (Natural Resource Conservation Service) and FSA (Farm Service Agency) offices in each county. There are two main conservation incentive programs that farmers should be familiar with: Continuous CRP (Conservation Reserve Program) and CREP (Conservation Reserve Enhancement Program).

There are many practices under the CRP - Continuous sign-up program where producers can be eligible. Some examples of eligible practices include Field Windbreaks, Grass Waterways, Filter Strips, Riparian Buffer Strips, Shelterbelts, Living Snow Fences and Cross Wind Filter Strips. Payments for adopting these practices are per acre payments similar to cash rent for your particular soil type. These payments are paid for 10 to 15 years depending on the program.

The CREP program is a partnership/combination of the RIM (Reinvest in Minnesota) and the CRP programs. Only land in the Minnesota River basin is eligible for this program. Approximately 100,000 acres is the targeted goal for the CREP sign up. CREP is a permanent conservation easement program, which allows the landowner to get incentive payments usually above the price of the land paid over a 15-year period.

The land under the agreement could not be used for farming, building, or any other purpose. The types of land that qualify for this program are generally marginal and lower producing land. An example of an eligible land parcel in the Minnesota River basin with land use options is presented below.

Let's examine an 80-acre parcel with eligible soil types in the Minnesota River Basin. The three options would include, 1) farming, 2) selling at assessed market value and 3) enrollment in the CREP. To simplify this comparison all figures are based on a per acre basis.

1. If the parcel is farmed:

(Marginal farmland would produce reduced yields)

	Corn	Soybeans
Income Yield:	120	35
Price	$2.00	$5.00
	$240.00 /A	$175.00 /A

Expenses:	Corn	Soybeans
Seed	35	17
($/A) Fertilizer	60	0
Chemicals	30	35
Fuel/Oil	9	8
Depreciation/Machinery	30	30
Repairs	23	21
Operating Interest	9	8
Crop Ins.	6	12
Family Living	30	30
	$232	$161

(Note: Family living is approximately $30 per acre. Taxes are not included due to variability).

Net return based on example:

Corn:	Soybeans:
$8.00/A	$14.00/A

2) If sold at market value:

The estimated market value per tillable acre is $1,608 from the County Assessor's office. The tax for the land is $17.81 per acre per year. The average PRODEX for the tillable acres is 66.4.

3. If enrolled in CREP:

The weighted average CRP payment for the two soil types, 956 and 1833 plus the incentive and maintenance payments totaled $136.35 per acre per year for 15 years.

The RIM (one time) payment at sign up was $656 per acre. Therefore, the total CRP payment for 15 years equals $2,045 plus the (one time) RIM payment of $656 would total $2,701 per acre. This is the total CREP program payment, $2,701 per acre, after 15 years.

Comparing the three options of land use:

If farmed:

the price and yield of corn and soybeans produced on the land plus the crop expenses are major variables.

If sold:

the market value is $1,608 per acre.

If enrolled in CREP:

the total payment for a permanent easement would be $2,701 per acre. Taxes would be $3.00 or less per acre per year depending on county tax policies.

The benefits of the CREP program are unbelievable! If farmers are looking for more farm income, enrolling marginal/lower-producing land in CREP is an option that can't be overlooked. Contact your county SWCD/NRCS/FSA office for more information, today.

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MINNESOTA

CROP NEWS

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

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Management Strategies for Delayed Planting

Dave Schwartz, McLeod Co. Extension Educator - Soybean Production

Rainy weather often delays planting in certain sections of the state. This year, fieldwork has been delayed in southern counties bordering Iowa. The latest Minnesota Agriculture Statistics Crop Report shows 60% to 75% corn planting complete in the very southwest corner of the state and little if any soybean planting progress. Another wet pocket has developed in the eastern edge of the Red River Valley where planting is also delayed. I know Extension offices field many questions at this time of the year when these situations arise. Below are planting recommendations for both corn and soybean growers when planting is delayed.

Corn

May 20-25 is the cutoff date for planting full-season hybrids. At this point, yields have been reduced 15% and growers risk harvesting wet, immature grain next fall. Growers should meet with their seed dealer and select hybrids that are 5-7 days earlier in maturity than what is considered full season for their area Around June 1, growers should select hybrids 10 to 14 days earlier than what is considered full season. By June 10-15, growers should consider planting soybeans rather than corn. The typical yield loss at this stage is 35-40%. There are no longer government deficiency payments, so growers aren't penalized for not planting corn.

Soybeans

Full season varieties should be planted through June 10. At this time, growers should shift to a variety maybe .5 maturity units less than their full season varieties. As an example, growers who traditionally plant soybeans in the 1.5 maturity group would switch to 1.0 maturity group June 10. The decision growers face is shifting to shorter maturing varieties (and sacrifice yield) or planting full season varieties that have more yield potential but will suffer from an early frost, reducing yield and quality.

Soybean plants are driven by photoperiod and catch up somewhat if planted later in the growing season. The same full season variety planted May 1 and May 30 may mature only 10 days apart in fall.

Soybeans planted the final two weeks in June will flower quicker and in general be smaller plants in both height and width so agronomists recommend using solid seed and increasing seeding rates 10 percent. Weed control pressure should be less when planting in June so growers can most likely rely on lower herbicide cost. The rotary hoe and cultivator will effectively control many late-emerging weeds in June.

In this issue

Fertilizing The Edible Bean Crop

George Rehm, Extension Soil Scientist

Edible bean production contributes substantially to many Minnesota farming enterprises. Appropriate use of fertilizers will improve production. Although research on fertilization of this crop has not been extensive, there are guidelines for fertilizer use. These guidelines are described in the sections that follow.

Nitrogen

Recommendations for nitrogen fertilizer use can be based on either the results of a **soil nitrate test** or a consideration of yield goal, previous crop, and soil organic matter content. The **soil nitrate test** is suggested when edible beans are grown on the fine-textured soils of western and northwestern Minnesota. This test should not be used as a basis for fertilizer nitrogen recommendations when edible beans are grown on soils with a sand, loamy sand, or sandy loam texture.

When the **soil nitrate test** is used, the fertilizer N recommendations are calculated from the equation:

$$N_{Rec} = (.05)\,(YG) - N_{ST} - N_{PC}$$

where:

YG = yield goal, lb./acre

ST = nitrate-nitrogen (NO_3-N) measured to a depth of 24 inches, lb./acre

N_{PC} = N credits for a previous crop, lb./acre

Research with edible bean production under irrigation on sandy soils shows that a rate of 120 lb. N per acre is appropriate for optimum yield. This rate is suggested for yield goals in the range of 2500 to 3000 lb. per acre in these production situations.

Recommendations for management of nitrogen fertilizers also vary with soil texture. Split applications are strongly suggested for the sandy soils. There are several options for split applications. Until research shows otherwise, one-half of the rate of nitrogen to be used should be applied approximately 2 weeks after emergence. The remainder can be applied just prior to bloom or about one week after bloom. The timing of the second application will depend on the method to be used. If fertilizer N is to be applied with the irrigation system, the last application can be made after bloom. If ground equipment is to be used, the last application should take place prior to bloom.

Split applications of nitrogen are not necessary for edible bean production on soils that are not sandy. For these fields, the nitrogen fertilizer can be applied either before planting or as a sidedress treatment. Considering the late date of planting common with edible bean production, a preplant application, followed by incorporation of the nitrogen fertilizer, would be preferred.

The edible bean crop has a shallow root system. This suggests that deep placement of nitrogen fertilizers may not be the most effective method of application. Therefore, use of anhydrous ammonia as a nitrogen source is not preferred. Application of urea or urea-ammonium nitrate with incorporation close to the soil surface is probably a better choice.

Phosphate and Potash

Current recommendations for the use of phosphate and potash fertilizers are summarized in the following tables.

Table 1. Phosphate recommendations for edible bean production in Minnesota.

		Phosphorus (P) Soil Test (ppm)				
Yield	Bray:	0 - 5	6 - 10	11 - 15	16 - 20	21+
Goal	Olsen:	0 - 3	4 - 7	8 - 11	12 - 15	16+
lb./acre		---------- P_2O_5 to apply (lb./acre) ----------				
1400 or less		30	20	15	0	0
1401 - 1900		35	25	15	0	0
1901 - 2400		45	30	20	10	0
2401 - 2900		55	40	25	10	0
2901 +		60	45	25	10	0

Table 2. Potash recommendations for edible bean production in Minnesota.

	Potassium (K) Soil Test (ppm)		
Yield Goal	0 - 40	41 - 80	81+
lb./acre	------- K_2O to apply (lb./acre) ------		
1400 or less	35	15	0
1401 - 1900	45	15	0
1901 - 2400	55	20	0
2401 - 2900	65	25	0
2901 +	75	30	0

The recommendations listed in these tables are suggested for either banded or broadcast applications. Do not apply any fertilizer in contact with the seed.

Micronutrients

Past research with edible beans has shown that zinc (Zn) is the only micronutrient that may be needed in a fertilizer program. The suggestions for the use of this micronutrient are summarized in the following table. Zinc deficiencies are usually found with the fine-textured soils that have a low soil test for zinc.

Table 3. Zinc recommendations for edible bean production in Minnesota.

	Zinc to Apply	
Zinc Soil Test*	Starter or	Broadcast
ppm	------ lb./acre ------	
0 - 0.25	2	10
0.26 - 0.50	2	10
0.51 - 0.75	1	5
0.76 - 1.00	0	0
1.01 +	0	0

** Zinc is extracted by the DTPA procedure.*

Rainy Weather Could Bring Out Rotary Hoes

Dan Martens, Benton County Extension Educator

Recent rains may have interrupted the sequence of tillage, planting, and putting on soil-applied herbicides. If 4 to 5 days have passed since the last tillage operation before planting, the rotary hoe may be your key tool for staying ahead of the first flush of weeds.

Check Herbicide Labels - for information about how rotary hoeing fits with products that have already been applied. Some labels will say that if you have not had 1/4 to 3/4 inch of rain within 4 to 7 days of applying soil-applied products you should rotary hoe or harrow (drag) to get some mix of the product with the soil. The rotary hoe takes out a lot of the weeds that have started to germinate below the soil surface. The amount of time since the last tillage ahead of planting is also very important.

Some labels, such as for products like Banvel and Clarity, say NOT to incorporate prior to corn emergence. Harrowing or rotary hoeing if these products are part of a soil-applied mix can cause injury to germinating and emerging corn. Rotary hoeing should be safe after the corn has emerged. Check with product labels or your herbicide supplier. Planting depth is also an important factor.

Check Fields. Find out whether weeds are starting to germinate by digging around in the top inch or two of soil and looking for little white threads of germinating weed seeds. Don't wait until you see weeds coming out of the ground.

Corn can be rotary hoed from planting until it is 4 to 8 inches tall, although most people would start cultivating before it reaches 8 inches. Some guidelines suggest corn should be planted 2 inches deep if a rotary hoe is part of the weed control program. Shallow seeded corn is more susceptible to damage from rotary hoeing.

Soybeans can be rotary hoed well before emerging and when they are in the one to two trifoliate stage. It is important to stay out of soybeans when they are in the "crook" stage just below the soil surface and for 3 to 4 days after emergence. The "crook" stage is the arch of the stem that emerges first, and then straightens to display the two seed leaf cotyledons. It is very fragile.

Check Again. When using a rotary hoe or harrow, get off and check field conditions regularly to be sure you are not doing excessive damage to the crop. Some farmers will plant 5 to 10% more corn per acre if they plan to use these tools.

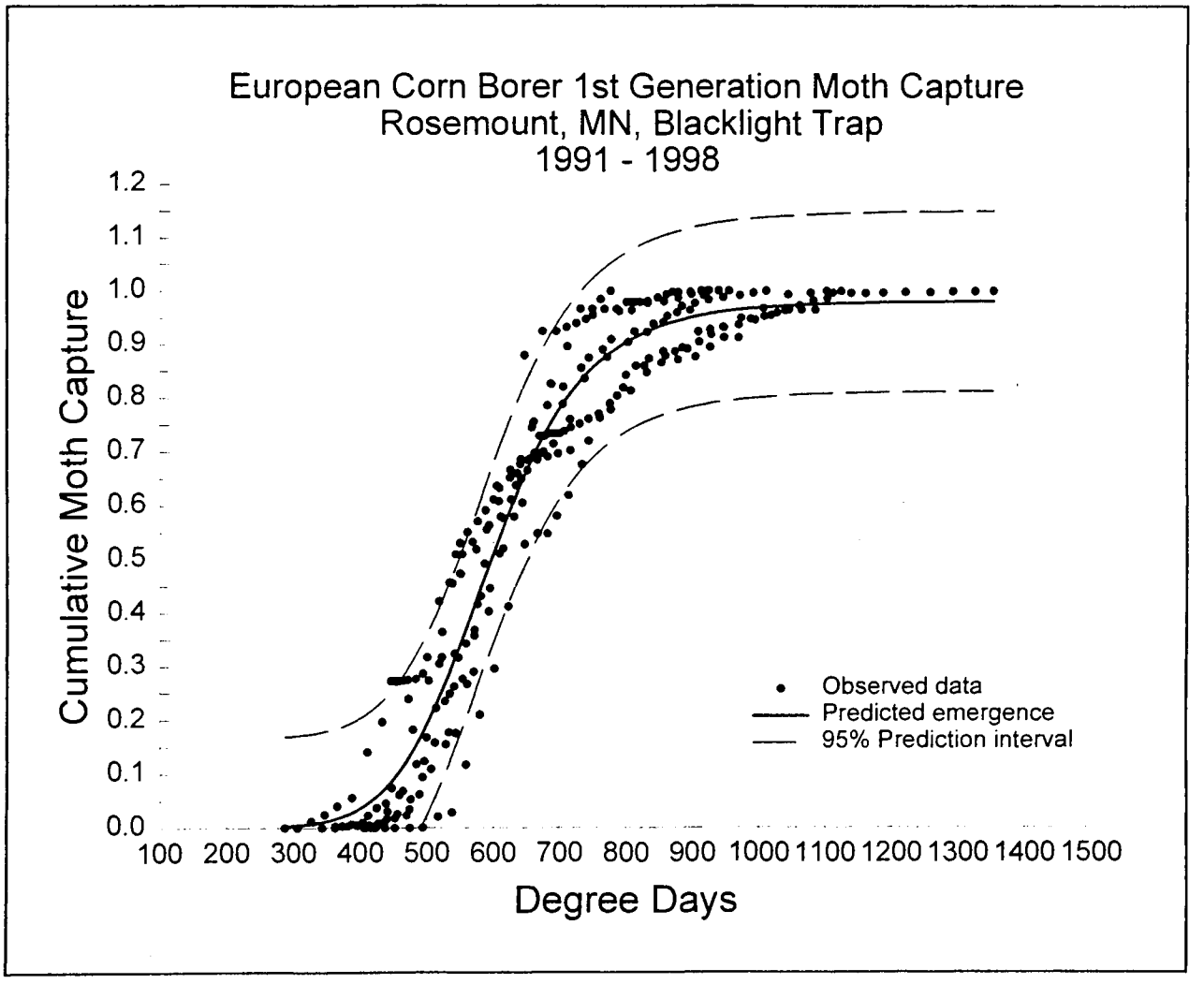
Rotary hoeing can enhance the performance of many weed control programs. But check product labels to make sure you are not setting the stage for crop injury by working specific chemicals into the soil zone where the crop seed is germinating.

European Corn Borer

Bill Hutchison and Eric Burkness, Extension Entomologists

Overwintering infestations of ECB remain low at our Rosemount research site (Dakota Co., southeastern MN). Larval counts on both April 13 and May 4 averaged 0.125 live larvae/plant (n=40 stalks/sample date; undisturbed site; no fall disking, etc.). These estimates are in agreement with the state-wide trend for low ECB numbers based on the 1998 Annual Fall ECB Survey, conducted by MDA personnel. One larva from the May 4th sample quickly pupated in the lab. (80F constant temp), indicating that some pupation should now be occurring in the field.

David Bartels (MDA Plant Pest Survey and BioControl Program) has provided an updated ECB Cumulative Emergence Model (see figure below), for first-generation ECB (bivoltine strain). This now includes our cumulative data set from 1991-1998, and illustrates the overall pattern of ECB moth emergence as a function of degree-days (base threshold 50F; sine-wave method). As shown, ECB emergence usually begins at approx. 300-400 DDs, with the peak flight at approx. 600 DDs. As of May 12, 1999, we were at approx. 223 DDs for the Rosemount location.



Using Hairy Vetch in the Cropping System

Joe Schafer, West Polk acting Extension Educator
Hans Kandel, Red Lake County Extension Educator

Interseeding hairy vetch (Vicia villosa Roth) in corn and sunflowers is an alternative opportunity for producers. Averaged over five environments with four replicates each, hairy vetch, when seeded at the four-leaf stage of sunflower, produced 1423 lb. of dry matter without reducing the sunflower yield. Corn and sunflowers, when grown in rows, will allow passage through the field while the crop is growing to spread the vetch seed. Interseeding can be looked at as a double cropping system for northern climates.In this specific case, we are utilizing sunlight and moisture (which normally go unused in the later part of the growing season) to produce a second crop, a green plow-down.

The greatest benefits of interseeding vetch are nitrogen fixation by the legume, increased organic matter (after incorporation of the vetch), and preventing soil erosion.

Before using interseeding, you must have clear objectives in mind, ones that match the potential of the interseeding system. To use vetch successfully you must have good weed control in the field. If you seed it into a weedy field, the vetch will grow but it will not compete with weeds. Vetch will only suppress weeds if it has had a chance to establish a mat. If it is seeded in the late summer and left over winter, in the spring it will quickly grow into a weed-choking mat. Seeding rates should be 15 to 20 lb. of live seed per acre to establish a thick stand. Vetch seed should be inoculated with Type C inoculant and incorporated to a depth of 1/2 to 1 inch in the soil.

Row cultivator equipment can vary greatly in how aggressively it tills, and some seed can be lost when a cultivator buries the seed too deeply. Vetch seed commonly contains 10 to 20% hard seed, which can remain in the soil to germinate in following years. The unwanted plants can be a problem in other crops. This is especially important for organic and no-till producers.

We used a simple broadcast seeder mounted on the front of the cultivator tractor to distribute the seed. This particular seeder cost about $400, and considering a 20-year life, would have annual cost of $20 for equipment. Time involved for handling the seed and filling the seeder is about one hour when cultivating a 100-acre field. Some calibration of the equipment is required. Overall, the expenses and time requirements are low for this system. The largest cost is vetch seed, which can range from $0.50 to $1.00/lb. Vetch seed can be produced on the farm, which would reduce the cost.

The timing of vetch seeding, which is a controllable factor will influence how well it produces, but uncontrollable environmental factors (weather, soil, etc.) can affect results just as much. We used the four-leaf stage in sunflowers as an optimum vetch seeding time. You may want to adjust this timing depending on the growth characteristics of the variety you use. For example, if you know the sunflowers you are planting are a dwarf variety with an open canopy, you should set back the vetch seeding to the six or eight leaf stage of the sunflower to prevent the vetch from growing too quickly and overrunning the sunflowers. Conversely, if the sunflowers are tall and thick, seeding earlier is called for.

Optimum use of interseeded vetch is not difficult to attain, but interseeding does require time to fine-tune it to an individual's farming operation and rotation. Vetch has proven to be a good grazing crop because it is fast growing and produces a large amount of biomass. One forage analysis of vetch hay we took shows it to have over 20% protein and over 120 RFV (Relative Feed Value).

If you plan to use vetch for hay, you must cut or graze it before it produces seed because the seed is considered toxic. Cutting or grazing before plants are in full bloom will prevent seed production. For more information call Hans Kandel at 1-800-770-1244.

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MINNESOTA

CROP NEWS

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

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Manure-Nitrogen Recommendation Changes

Mike Schmitt and Gyles Randall

Recent changes in the University of Minnesota manure-N management guidelines may be causing some confusion. Because of these changes, please discard the older, existing materials and use the new *Manure Management in Minnesota* bulletin, University of Minnesota Extension FO-3553, revised 1999.

A major change has been the N availability in swine manure. When swine manure is applied to fields, our availability indices increased by about 15% compared to our previous values. Thus, for sweep-injected and knife-injected manure, N availability in the first year would be 80 and 70%, respectively. We have conducted and analyzed numerous site-years' worth of data to arrive with these new values. We are confident that we are not putting crop/livestock farmers at greater risk with these new indices.

Second, we no longer assume a standard swine manure N content of 36 lb N/1000 gallons. We have now separated swine manure into the categories of Farrowing, Nursery, Gestation, and Finishing with mean manure-N values of 27, 34, 40, and 53 lb N/1000 gal, respectively. For years everyone has known that different stages of growth correlate to different diets and different manure-N values. We are very confident in our new values as they came from a Minnesota project with over 225 swine farms making up the database.

Finally, the University of Minnesota no longer formally acknowledges a third year manure-N credit. Our data suggest that depending on third-year availability of manure-N is risky. Increased availability in the first and second years almost precludes any third-year N credit from manure applied at "agronomic rates."

All of these changes are outlined in the **1999** revision of University of Minnesota Extension FO-3553, *Manure Management in Minnesota*.

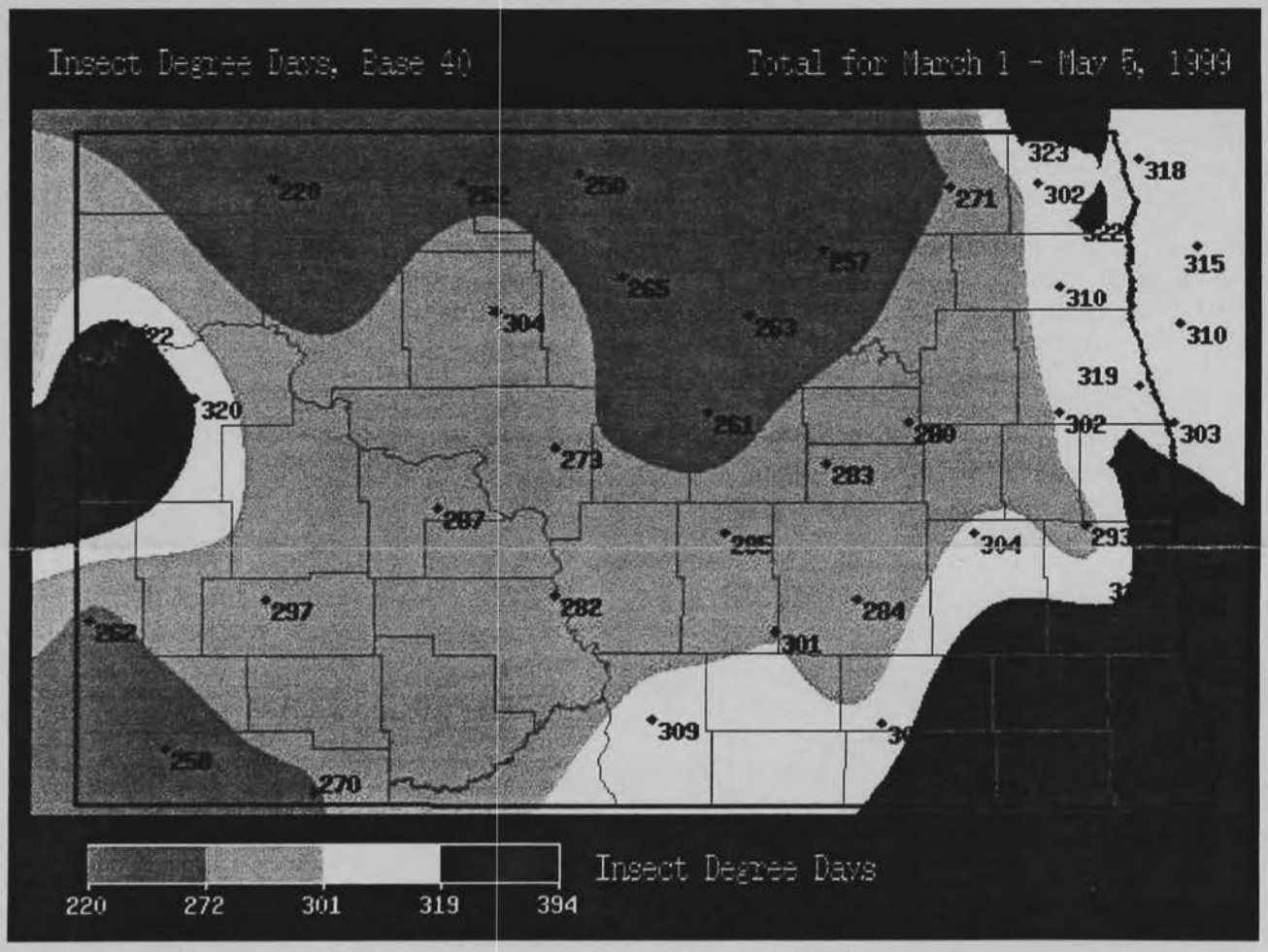
In this issue

Orange Wheat Blossom Midge and Planting of Wheat

Ian MacRae, Extension Entomologist
Jochum Wiersma, Small Grains Specialist

Dr. Phil Glogoza, NDSU Extension Entomologist, for several years has tested and used the growing degree day model to predict emergence of Orange Wheat Blossom Midge. The same growing degree model can be used to calculate a risk window for planting wheat. In this period the chances that OWBM emergence and heading of wheat will coincide later in the season are greatly increased.

Wheat planted prior to 150 - 200 DD accumulations would be at relatively low risk for midge infestation. Wheat planted after the accumulation of 600 DD should be heading and flowering after significant midge activity and should be at low risk to infestation. Below, courtesy of Dr. Phil Glogoza, is the average growing degree day accumulations for North Dakota and the Red River Valley. Note that fields planted since the beginning of this month have entered this window in which the development of the wheat and the emergence is likely to synchronize and may become a problem during heading. Field planted after the first of the month are good candidates for scouting for OWBM later this season, while earlier planted field likely will require little or no scouting for OWBM. You can check the maps daily at the following Internet address: **http://www.ext.nodak.edu/weather/idd/idd40.gif**. Dr. Phil Glogoza also maintains a website with more information about the Orange Wheat Blossom Midge at **http://www.ndsu.nodak.edu/entupdates/**



Vegetables – 1999 Regional Pest Management Guide

Bill Hutchison and Eric Burkness, Extension Entomologists

A few copies (approximately 55) of our revised regional publication, *Midwest Vegetable Production Guide–1999, For Commercial Growers* (BU-7094-S; retail $8.00) are still available through county extension offices or from the Extension Distribution Center (612-625-8173). As in previous years, many updates were made regarding pest thresholds, new product labels and/or label changes. The guide provides current information on labeled used for insecticides, fungicide, and herbicides on all vegetables grown in the midwestern U.S. The publication is also available at the Purdue University www site (http://www.entm.purdue.edu/Entomology/ext/targets/ID/index.htm) where changes during the season are also posted (look under publications and interdisciplinary publications).

Winter Applications of Manure

Tim Wagar, Area Extension Educator
Steve Pahs, Goodhue Soil and Water Conservation District

Livestock producers who need to apply animal wastes throughout the year always have questions about the availability of nutrients in the manure that was applied during the winter. In an attempt to answer that question, an on-farm field demonstration was conducted to demonstrate the effect of winter applications of dairy manure from a scrape and haul system on the following corn crop.

Strip plots were established on a Vasa silt loam with 0-2% slopes in Goodhue County. The manure that was used had 11.5 lb. total N/ton; 5.2 lb. P2O5/ton; and 11.6 lb. K2O/ton. The farmer/cooperator applied 25 tons of manure on each strip in November, December, January, and February. A urea fertilizer strip that was comparable to the amount of available N in the manure (60 lb. N/A) was spring applied and a check strip was included as well. The plots were not replicated. Corn yield results are listed in the following table.

Although the strip plots were not replicated, there were interesting trends in the results. The most obvious was the substantial difference of corn yield in the check strip. In addition, the November manure application had attained about the same yield as the spring urea treatment. This result is consistent with the University of Minnesota recommendation, where fall application of manure is the most effective use of nutrients for the following crop. Manure applied on plots during December, January, and February resulted in slightly lower corn yields probably due to a lag in the mineralization of organic matter contained in the manure.

Farmers who need to apply manure during the winter months should attempt to use the most level ground available with the greatest amount of crop residue or soil surface roughness to keep the manure nutrients where they have been applied.

Winter Manure Application Demonstration
Ed McNamara Farm - Goodhue County

Treatment	Yield
	Bu/A
Check 0 lb. N/A	95.6
November	139.8
December	128.3
January	129.0
February	123.2
Spring urea 60 lb. N/A	141.3

Coleoptile Length and Planting Depth

Jochum Wiersma, Small Grain Specialist

The rule of thumb for small grain seeding depth is 1.5 to 2 inches. The objective of seed placement is to get the seed in a zone with ample moisture but shallow enough for the crop to emerge quickly. Adjusting and monitoring of your seeding depth are pivotal in reaching the above stated objective.

With the introduction of semi-dwarf varieties, depth control became even more important because of the shorter coleoptile of semi-dwarf wheat. The coleoptile is a leaf sheath which surrounds and protects the first true leaf as it grows from the seed towards the surface. If the coleoptile is shorter than the depth of planting, emergence will become difficult. The young seedling might not reach the surface and ultimately will die, resulting in stand loss.

There is a fairly good correlation between overall plant height and coleoptile length; taller cultivars tend to have longer coleoptiles. In other words, if you are planting a taller wheat cultivar, you have more layaway with the depth control on your planter. When planting shorter semi-dwarfs, depth control becomes absolutely critical.

The two tables below show the average coleoptile length in millimeters and inches for the most common wheat and barley cultivars in the region. You will note that on the average barley cultivars have shorter coleoptiles than wheat, demonstrating once again the need to carefully calibrate and monitor seeding depth.

Table 1: Average coleoptile length of common hard red spring wheat cultivars.

Cultivar	Length (mm)	Length (inches)
McVey	100.5	4.1
Gunner	99.6	4.1
Forge	98.6	4.0
Ingot	97.3	4.0
Bacup	91.7	3.7
Russ	85.5	3.5
Pioneer 2375	84.8	3.5
AC Barrie	78.7	3.2
Sharpshooter	76.0	3.1
Nora	73.5	3.0
HJ98	73.4	3.0
Oxen	73.0	3.0
Hagar	72.1	2.9
Argent*	71.9	2.9
Grandin	70.0	2.9
Verde	69.8	2.8
Marshall	67.5	2.8
Lars	60.9	2.5
Ivan	47.7	1.9
LSD	11.6	0.5

** Argent is a hard white spring wheat*

Table 2: Average coleoptile length of common barley cultivars.

Cultivar	*Length* (mm)	*Length* (inches)
Robust	69.3	2.8
MN Brite	55.0	2.2
Stander	49.4	2.0
Foster	49.1	2.0
LSD	7.5	0.3

Canola Planting Date

Ervin A. Oelke - Extension Agronomist

It is important to plant canola early because it is more sensitive to heat stress during flowering and seed fill than all small grains, flax, and other cool season broadleaf crops. Once weather conditions are favorable to preparing a good seedbed, canola should be planted prior to small grains to avoid the potential of decreased yields due to late planting. A combination of low moisture and high temperatures during flowering and pod set can substantially reduce yields.

Planting too early could risk spring freezing temperatures. Seedlings could be killed by sudden exposure to 26 to 28°F, but if seedlings are "hardened-in" by slowly falling temperatures, they can withstand temperatures as low as 16 to 20°F. Canola seedlings will usually recover from light spring frosts that do not damage the growing point.

A four-year date of planting trial conducted at two locations (near Crookston and Roseau) showed a decrease in yield of about 1% per day when planting was delayed after the first possible planting dates of late April or early May. Table 1 shows the data from the 1998 trial conducted on the Monte Cassavan farm near Crookston. The canola response to planting data was similar for the other years and location.

Table 1. Average yield and plant characteristics of six varieties planted on six dates in 1998 at Crookston, MN.

Date Planted	Yield* (lbs/A)	Yield % of date 1	Test Weight (lbs/bu)	Begin Bloom DAP	End Bloom DAP	Bloom Duration Days	Maturity DAP	Oil (%)	Protein (%)
April 24	2559	100	52.1	46	69	23	91	39.6	23.4
May 19	2052	80	52.0	40	59	19	81	38.4	24.9
May 28	1794	70	52.1	37	57	20	77	36.5	25.9
June 8	1473	58	52.4	36	56	20	77	35.1	26.5
June 23	1131	44	52.1	35	51	16	75	36.0	26.5
July 2	970	38	51.4	34	49	15	76	35.6	26.8
Mean	1663	---	52	38	57	19	79	36.9	25.7
LSD (0.05)	205.7	---	0.38	0.9	1.1	0.9	1.4	0.74	0.59
CV	9.7	---	1.0	1.7	1.8	5.8	1.6	1.9	1.9

*At 10% moisture.

Some of the increase in yield for the late April planting date can be attributed to the longer bloom (flowering) period (compared to plantings at the later dates), allowing for more pods being produced. The earlier planting also allowed more days for the plants to grow and mature, thus using more of the growing season to produce yield. Oil percentage was the highest at the early planting date, but protein percent was the lowest (Table 1).

Six varieties were planted in the four-year trial: two early ones (Hysyn 110 and Reward), two midseason ones (Hyola 330 and Topscore), and two late ones (Crusher and Global). It was thought that the early varieties would perform better when planted late, however this was not true. The best overall performance was obtained with the two midseason varieties, Hyola 330 and Topscore. The late varieties did well when planted early but yielded the least when planted late (late June, early July). The maturity of 92-93 days to swathing time of the medium maturity varieties gave good yields at the late April to late May planting dates. In Northwest Minnesota if planting can be done during late April and early May the late and midseason varieties can be planted. Medium maturity varieties should be considered for later plantings. However, other characteristics of the varieties such as disease resistance, lodging, and yield potential should be considered in addition to maturity.

Flue-Gas Residue and Crop Nutrients

George Rehm, Extension Soil Scientist

Recently questions have been raised about the nutrient value of desulfurization residue, a by-product of coal-fired electrical generating stations. This residue has potential value as a liming material. It also contains significant amounts of magnesium (Mg), sulfur (S), boron (B), and potassium (K).

The residue, produced by scrubbing sulfur dioxide (SO_2) from the flue gases of coal-fired electrical generating stations, is considered an excellent source of micronutrients, particularly B. Studies were conducted in Wabasha County in 1996 and 1997 to document the availability of B in this material for alfalfa production.

In one study, this flue-gas residue was broadcast and incorporated before seeding alfalfa in August of 1995. The material was broadcast at rates of approximately 1,000 and 8,000 lb per acre. These rates supplied approximately .3 and 2.7 lb. B per acre. In an added treatment, borax was used to supply 2.7 lb. B per acre. Alfalfa yields were measured for two years following the application of the various treatments in April 1996.

The same treatments were topdressed in April 1996 to an established stand in an adjacent field. All treatments at both sites were fertilized with adequate amounts of phosphate and potash.

The concentration of the B in the alfalfa tissue was measured at each harvest.

During the summer of 1995, alfalfa grown on an adjacent field had exhibited B deficiency symptoms. This visual observation was used as the basis for selection of the experimental site. Selected soil properties for the experimental site are listed below.

PH	6.5
organic matter	1.3%
boron test	0.5 ppm

The alfalfa yields for the two experimental sites are summarized in Table 1. Yields from both 1996 and 1997 are reported.

Table 1. The effect of boron applied either with or without desulfurization residue on the total yield of alfalfa for each growing season at two experimental sites.

		Site and Year			
Flue-Gas	B	Applied Before Planting		Topdress	
Residue Applied	Applied	1996	1997	1996	1997
lb./acre	lb./acre	tons/acre			
-	0	3.5 a[1/]	2.6 a	3.9 a	2.4 a
0	2.7	3.6 a	2.9 a	3.9 a	2.6 a
1000	0.3	3.3 a	2.8 a	4.0 a	2.7 a
8000	2.7	3.4 a	2.7 a	3.7 a	2.6 a

[1/] Treatment averages in each column followed by the same letter are not significantly different at the .05 confidence level.

None of the treatments used had a significant effect on alfalfa production. With an initial soil pH of 6.5, a response to lime would not be expected and no response was observed. The soil test for B of 0.5 ppm is considered marginal. Although deficiency symptoms for B were observed in the dry portion of the summer of 1995, there was no increase from the application of B when yields were measured in the summers of 1996 and 1997.

It's also important to note that the use of the flue-gas residue did not decrease alfalfa production. There is always some concern about potential harmful effects when products such as this residue are applied to soils. No harmful effects were observed in this study.

Alfalfa plants collected at each harvest were analyzed for B in an effort to measure the availability of the B applied. The results from the site where the B was broadcast and incorporated before planting are summarized in Table 2 (top of p. 43).

The treatment used had no effect on the B concentration in the tissue of the first cutting. For the second and third cuttings, B concentration was increased by the application of 2.7 lb. B per acre compared to 0.3 lb. B per acre. The B in the flue-gas residue was as available as B supplied from a commercial borate fertilizer.

The results of this trial show that the flue-gas residue can be used as a source of B, when needed, for crop production. The material also has some liming value and can also be used as a source of S. There were no observed negative effects from the use of the flue-gas residue on alfalfa production.

Table 2. The effect of boron applied either with or without desulfurization residue on the boron content of whole alfalfa plants harvested in 1996.

Flue-Gas Residue Applied lb./acre	B Applied lb./acre	Cutting 1	2	3
		ppm B		
-	0	33.8 a[1/]	31.3 a	24.1 a
0	2.7	32.4 a	41.0 b	36.8 b
1000	0.3	32.9 a	32.8 a	24.8 a
8000	2.7	30.3 a	37.1 b	35.3 b

[1/] *Treatment averages in each column followed by the same letter are not significantly different at the .05 confidence level.*

Compatibility

Bruce Christensen, Houston County Extension Educator

Is fungicide-treated seed compatible with Rhizobium inoculants? The compatibility of these two products depends on the pesticide, the formulation of the pesticide, the carrier of the inoculant and the time period the two products are combined on the seed. If a liquid fungicide is applied to the seed, allow it to dry prior to applying the inoculant. Keep the time that the products are in combination to a minimum prior to planting, (preferably less than four hours). In-furrow inoculant applications may be better than applications to treated seed. Two web sites listing compatibilities of inoculants and other seed treatments can be found at liphatech.com and urbanalabs.com.

Samples Submitted to the Plant Disease Clinic in April

Sandra Gould, Plant Disease Clinic

wheat–cultured for storage molds

barley–tested for loose smut

haylage–cultured for storage molds

lilac–*Phytophthora* sp and *Rhizoctonia* sp stem rots

geranium–*Xanthomonas campestris* pv *pelargonii* bacterial wilt, *Pseudomonas solanacearum* bacterial wilt. *P. solanacearum* has a wide host range, so symptomatic plants and soil should be removed and destroyed to avoid spread to other hosts.

dianthus–impatiens necrotic spot virus (INSV)

veronica–*Botrytis* sp stem rot, INSV

primrose–INSV

lamiastrum–INSV

cineraria–INSV

salvia–INSV

marigold–INSV

allium–INSV

pachysandra–INSV, *Phyllosticta* sp leaf spot

galium–bacterial leafspot

ajuga–cucumber mosaic virus (CMV), alfalfa mosaic virus (AMV)

hosta–hosta virus X

dicentra–tobacco rattle virus

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MINNESOTA

CROP NEWS

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

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Cultivation—Herbicide Use—Soybean Production

George Rehm, Extension Soil Scientist

If weed control is satisfactory, do I need to cultivate soybeans? If I cultivate soybeans late, will I prune roots and harm yields? Will I reduce soybean yields if I don't cultivate? These are some of several questions being asked by crop producers when they discuss the topic of cultivating soybeans. As today's crop producers farm more and more acres, the use of the cultivator in the soybean crop is becoming less popular. This is especially true when soybeans are grown in ridge-till or other conservation tillage production systems.

To help in providing an answer to some of these questions, a study was conducted in the field of a cooperating farmer in Kandiyohi County to measure the effect of cultivation with an without post-emergence herbicide use on soybean yield. The soybeans were planted in a ridge-till system in 30-inch rows. Single-row and twin-row planting configurations were used each year.

The average yield for soybeans planted in single rows in 1997 and 1998 are presented in **Table 1** on page 34. Soybean yields for the same two years, when planted in twin rows, are presented in **Table 2**, page 34.

The post-emergence herbicide program was not the same each year. Roundup-ready soybeans were planted in 1998. A single application of Roundup (24 oz. per acre) was used on June 19. Soybeans were cultivated on June 26 and July 9 for the treatments where a second cultivation was to be used.

A combination of herbicides was used in 1997. The first application of Assure II (5 oz. per acre) was made on June 11. This was followed by a combination of 2 oz. Pursuit, ½ pint of Basagran, and 1/16 oz. Pinnacle per acre on June 16. The first cultivation was completed on July 9. The second cultivation, if called for in the experimental plan, was completed on July 23.

The benefit of the use of the post-emergence herbicides in both planting configurations is obvious. Even though cultivation was used in both planting configurations, yields were approximately 20 bu. per acre higher when the post-emergence herbicides were used. The cultivation without herbicide use was not very effective in controlling weed growth. As a result, yields were reduced substantially. The yield response from the use

In this issue

Cultivation/continued

of the post-emergence herbicide was more than adequate to pay for the herbicide.

The post-emergence herbicide program was effective in controlling weed growth each year. The impact of the second cultivation, however, varied with planting configuration. With single rows, there was a slight decrease in production when soybeans were cultivated twice (**Table 1**). Without herbicide use, the reduction was approximately 5 bu. per acre. By contrast, the use of two cultivations produced an increase in soybean yield (**Table 2**). If no herbicide is used, a yield increase following two compared to one cultivations might be expected.

However, this is no easy explanation for a small yield decrease when one cultivation is compared to two cultivations.

It is reasonable to expect a late cultivation to cut roots and thereby reduce water and nutrient uptake by soybeans. However, it is difficult to formulate an explanation for the differences measured in the two planting configurations. Although measurements were not taken, it is possible that patterns of root growth were different in the two planting configurations.

Table 1. The effect of cultivation and herbicide use on yield of soybeans planted in single rows in a ridge-till planting system.

Number of Cultivations	Herbicide Use	
	no	yes
	- - bu./acre - -	
0	17.0	46.3
1	24.9	46.2
2	19.7	43.2

Table 2. The effect of cultivation and herbicide use on yield of soybeans planted in twin rows in a ridge-till planting system.

Number of Cultivations	Herbicide Use	
	no	yes
	- - bu./acre - -	
0	16.6	43.8
1	23.9	44.6
2	30.8	48.0

With current commodity prices, there is always a temptation to eliminate some inputs or substitute cultivation for herbicide purchases. The results of this study show that decisions to make this substitution could result in reduced soybean yields and a loss of any potential profit.

Attention Canola Producers: Pesticides Must be Used According to Label

John Sierk, Pesticide Regulatory Consultant, Minnesota Dept. of Agriculture

Any pesticide intended for use in the U.S. must be registered by the Environmental Protection Agency (EPA). A registration is a license allowing a pesticide product to be sold and distributed for specified uses in accordance with specified use instructions, precautions, and other terms and conditions. Pesticide registration decisions are based on EPA's evaluation of a specific set of scientific test data to determine whether a pesticide has the potential to cause adverse effects on human health or the environment. Registration requirements apply not only to every pesticide, but also to every use of every pesticide. As part of the registration process, EPA establishes allowable amounts of pesticide residues that may remain in agricultural commodities. This means that certain pesticide residues on our food are legal and within the EPA's range of "acceptable" risk. A pesticide can be legally used on a food crop only if the EPA has established a residue level for that use. All research, testing, and regulatory processes ultimately are reflected through the language found on the pesticide product label. Pesticide laws require all pesticides to be used only as directed by the label and every pesticide label includes the statement, "It is a violation of federal law to use this product in a manner inconsistent with its labeling."

The Minnesota Department of Agriculture (MDA) wants to remind farmers, dealers and applicators that pesticides must be used according to label directions. Specifically, the MDA is concerned that the fungicide Benlate (benomyl) and the herbicide Banvel/Clarity (dicamba) may have, in the past, been used on canola. Benlate and Banvel/Clarity have not had allowable residue amounts established for canola and are not labeled for use on canola (Benlate can be used as a seed treatment only). As a result, it is illegal to make foliar applications of Benlate or Banvel/Clarity to canola. Canola that is found to contain residues of an unlabeled pesticide becomes useless and can not be sold. Additionally, persons caught misapplying pesticides may be subject to fines and suspension of their applicator's license.

Alfalfa Scissors Cutting Time is Near

Terry Salmela, Kanabec County Extension Educator

Soon it will be time to begin alfalfa scissors-cutting to help producers better determine when to begin cutting first crop alfalfa. Here are some tips to remember when doing scissors cutting and when to begin cutting hay.

1. Select pure stands of alfalfa. If possible, take separate samples from several farm fields in different parts of the county or multi-county area.
2. Sample five or six days. Alfalfa should be 12-15 inches tall. Mondays and Thursdays work well.
3. Sample at the same time of the day. Preferably between 7 and 9 a.m.
4. Sample from at least 4-5 locations in the field. Take a total of from 10 to 30 subsamples to get one-half to one gallon, enough for lab testing.
5. Walk in the same general area each time.
6. Walking in an "M" shaped pattern works well.
7. Using a shrub pruning nippers works well. Cut each grab sample at a 3-4 inch (fist) height above the ground. Take an average sized handful at each location.
8. Separate out any grass or weeds.
9. Put the sample into a paper bag if hand delivering to the lab. Or bag as suggested by the lab if mailing the sample.
10. Label and date each bag. Record the average height of alfalfa plants around each subsample and average the heights to help keep track of how fast alfalfa is growing between samplings.
11. Deliver samples to the lab, which has agreed to test samples and provide same day faxed results.

Results can be shared with producers and the public via radio, put on the county dial-in INFO-U 800 number, in newspapers, on DTN, by post card from the lab to forage council members, etc.

This May, Salli Weston and Craig Sheaffer will continue to coordinate a statewide alfalfa scissors-cutting program. They will develop information and report it on a web site. The target date to begin is May 10th. Alfalfa Scissors-Cutting results can be e-mailed to Salli at Westo006@tc.umn.edu. Her phone number is 612-625-8189. The results can be seen at http://www.agro.agri.umn.edu/rp/projects/scissors/whats_new.htm Salli will also try to get the results or a map on DTN.

Forage quality needed for various animal classes.

Livestock	Relative Feed Value (RFV)
Early Lactating Dairy Cows	150+
Mid-Late Lactation Dairy Cows	125-145
Dairy Calf	140-160
Dairy Heifer (3-6 months)	125-145
Dairy Heifer(12-18 months)	115-130
Dairy Heifer(18-24 months)	100-115
Dry Dairy Cow	100-115
Stocker and Lactating Beef Cows	120-130

It seems that there is always plenty of poor quality hay. Therefore, whether one is a dairy farmer or could sell alfalfa to a dairy, it usually always pays to put up as much high quality hay as possible. If one's goal is to try to harvest alfalfa of 150 RFV or higher one needs to begin when the RFV is in the 190 to 200 RFV range. This will allow for about 15% harvest loss, 3-4 points of RFV drop each day during the harvest period and allow for adjustments due to local field conditions. This will hopefully allow enough time to harvest all the alfalfa before any of it reaches the 150 RFV level.

In five years of Alfalfa Scissors-Cuttings in East Central Minnesota counties the RFV passed the 200 mark on these dates. In 1994—May 21th, 1995—May 27th, 1996—June 5th, 1997—June 3rd, 1998—May 9th.

This spring started out like 1998. However, alfalfa growth has been slow due to cool and cloudy weather. Sun and higher temperatures are needed for growth.

Alfalfa Scissors-Cutting is a good project for Forage Councils, Extension staff, crop consultants, ration advisors, coops and producers to use as a tool to determine the optimum time to begin cutting that all important first cut alfalfa.

Samples submitted to the Plant Disease Clinic in April

Sandra Gould, Plant Disease Clinic

soybean—soybean cyst nematode
barley—samples tested for loose smut
turf—cultural, no disease was found
penstemon—Impatiens necrotic spot virus (INSV)
pachysandra—*Volutella* sp stem rot
N.G. impatiens—INSV
fuchsia—*Pythium* sp and *Rhizoctonia* sp root rot
petunia—Tobacco mosaic virus (TMV)
coleus—INSV
heliotrope—INSV
ajuga—Alfalfa mosaic virus

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IN THIS ISSUE — *Minnesota Crop News* — APRIL 23, 1999

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CROP NEWS

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

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Alfalfa—An Excellent Crop for the System

Zachary Fore, Cropping Systems Specialist, Northwest Minnesota

Alfalfa has many characteristics that make it an excellent component of a cropping system. We can and do grow a great variety of crops in Minnesota. However, with few exceptions, these crops are summer annuals—planted in the spring and harvested in the fall. Alfalfa is a perennial that remains in the same field for 3 to 5 years. This characteristic makes alfalfa especially valuable for weed and disease control. Alfalfa is a legume so it does not require nitrogen fertilizer. Many crops yield extremely well following alfalfa. And alfalfa has been a profitable crop to grow in recent years. Following are some specific details about the benefits of alfalfa in the cropping system.

Profitability. Alfalfa has been one of the most profitable crops produced in recent years. Total production costs for alfalfa in Minnesota average from $125 to $175/A. Yields have averaged about 3 T/A, with the best growers getting over 4 T/A. Prices have averaged $55 to $60/T, with a range from $46 to $77/T. When calculating potential returns to alfalfa keep in mind that yields will be lower in the establishment year. An average yield for first year direct seeded alfalfa is 1.5 T/A. The following table shows different gross returns for various alfalfa yields and prices.

Alfalfa Gross Returns

	Yield (T/A)						
Price ($/T)	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
40	80	100	120	140	160	180	200
50	100	125	150	175	200	225	250
60	120	150	180	210	240	270	300
70	140	175	210	245	280	315	350
80	160	200	240	280	320	360	400
90	180	225	270	315	360	405	450
100	200	250	300	350	400	450	500

Improved Workload Distribution. Alfalfa in your cropping system can help improve the distribution of your workload. As many alfalfa producers will tell you, harvest dates come about Memorial Day, the Fourth of July, and Labor Day. This gives you time to plant your other crops and harvest them with minimal interference from the alfalfa crop.

Erosion Control. Alfalfa is an excellent crop for reducing soil erosion. Alfalfa can easily reduce soil loss by 50% to 80% compared to small grains, corn, or soybeans. Erosion control is especially important on slopes and in areas with high soil loss potential.

In this issue

Alfalfa/Continued

Weed Control. Alfalfa is a competitive, perennial crop that is mowed frequently. In addition, tillage, which brings to the surface buried weed seeds, does not take place in established alfalfa. These properties of alfalfa make it an excellent crop for suppressing weeds. Our current cropping system of predominantly summer annual crops selects for certain weeds species, such as foxtails and pigweeds, that are well adapted and very competitive with summer annual crops. Alfalfa effectively breaks the cycle of these weeds. Alfalfa producers will tell you that fields coming out of alfalfa are the cleanest fields they have. A producer recently told me, 'When I used to grow alfalfa I was able to keep wild oats under control. Since I quit growing alfalfa I've got wild oats everywhere.'

Disease Control. Alfalfa is an excellent crop for breaking certain disease cycles. Alfalfa is a broadleaf crop, and is not a host for scab and most other diseases which attack grass crops such as wheat, oats, barley, and corn. In addition, alfalfa has a low susceptibility to sclerotinia white mold. Sclerotinia spore bodies can remain viable in the soil for 5 years or more. Alfalfa is typically in a field for 3 to 5 years. During this time the sclerotinia inoculum can be greatly reduced.

Nitrogen Fertility. Alfalfa is a legume, and is extremely efficient at converting atmospheric N, which plants cannot use, to nitrate and ammonium N, which plants can use. While the alfalfa crop is growing it is using all the N it is 'fixing'. However, when the alfalfa crop is tilled into the soil a significant amount of N becomes available to the following crop. The amount of N that becomes available depends on the density of the alfalfa stand and the amount of alfalfa growth present when the stand was tilled in. (For detailed recommendations please refer to University of Minnesota Extension soil fertility recommendations and publication FO-3769 *Providing Proper N Credit for Legumes* by O'Leary, Rehm, and Schmitt.) When corn is planted where a good stand of alfalfa (5 or more plant/sq. ft.) was tilled in, nitrogen requirements may be reduced by up to 150 lb/A the first year and 75 lb/A the second year. Wheat nitrogen requirements may be reduced by up to 100 lb/A the first year and 35 lb/A the second year following a good alfalfa stand.

Rotation Response. Most crops yield extremely well when planted where alfalfa was the previous crop. Weed control, disease control, and N fertility are at least partially responsible for this response. It is likely that other factors which we don't understand at this time also contribute to this positive rotation response. Grass crops and non-legumes follow alfalfa especially well. For example, in a 10 year rotation study in Wisconsin, corn yields following alfalfa were greater than yields with continuous corn, even when the continuous corn had 300 pounds of nitrogen applied per acre.

Marketing and Quality. Many growers are deterred from producing alfalfa because alfalfa can be difficult to market. Alfalfa can't be just hauled to the elevator. Successful alfalfa producers know that quality is essential in marketing alfalfa. There will always be a market for the best quality alfalfa. High quality alfalfa is a result of a number of factors including cutting at the right time, baling at the right moisture content, having weed free fields, avoiding weathering in the field, and storing promptly and carefully. Buyers want alfalfa that not only has a high relative feed value, but also looks and smells good. Good management commands a premium in the alfalfa business.

The bottom line is, alfalfa can be grown profitably, and can improve the profitability of other crops grown in a rotational system with alfalfa.

Performance of Soybean Cyst Nematode Resistant Varieties in Southeast Minnesota

Submitted by Tim Arlt on behalf of the SE Minnesota Soybean Education Program

Introduction

As part of a demonstration/research project to help Minnesota soybean growers be more profitable, an evaluation of Soybean Cyst Nematode Resistant Varieties (SCN) was undertaken in Southeast Minnesota. SCN resistant varieties for Minnesota are becoming more prevalent every year. Research has shown that the use of SCN resistant varieties in conjunction with crop rotations and other cultural practices can greatly enhance yields and in some cases can significantly reduce egg counts.

There can be both positive and negative effects of using SCN resistant varieties. The primary advantage is that significant yield increases can be obtained in SCN infested fields. Yield advantages of SCN resistant varieties over nonresistant varieties is variable and not all resistant varieties are going to perform the same from field to field. The yield of resistant varieties is a function of breeding, agronomic conditions and level of infestation in the field. A secondary benefit of some resistant varieties is the significant reduction in egg counts.

A major disadvantage of SCN resistant varieties is the yield drag in fields with low or no SCN infestation. This can be seen in yield trials from the University of Minnesota Southern Experiment Station at Waseca. Also, some of the resistant varieties are a longer maturity than nonresistant varieties available throughout the state.

Demonstration/Research Methods

The purpose of the Southeast Minnesota Soybean Growers Education Program was to extend the information that has been developed by University Specialists to area farmers and to enhance the research base for SCN varieties in Minnesota. The project was a coordinated effort between Extension and the Southern Experiment Station at Waseca, specifically Senyu Chen and Curt Reese. Two farmers agreed to cooperate with the University of Minnesota team to establish on-farm demonstration/research sites in Goodhue County near Kenyon, and Freeborn County near Geneva. Sites were selected for uniform soil type, for easy access to view plots, for public visibility and for level of SCN infestation.

Prior to planting, the sites were selected based on the history of the field and the known presence of SCN within that field. Soil Samples were taken early in the spring and analyzed for SCN eggs. The egg counts were about 300-eggs/100cc soil at the Kenyon site and about 30,000-eggs/100 cc soil at the Geneva site. While the Geneva site had egg counts higher than what is currently recommended for the use of SCN resistant varieties, it was a good test of the yield potential of these varieties.

The demonstration plots were situated on a Mayer loam at the Geneva site and on a Mount Carroll silt loam at the Kenyon site. These are common soil types for these areas of the state. Soybeans were planted May 14 at both sites and herbicides were applied 5 days later. All plots were cultivated and hand weeding was done where necessary.

Thirty-six varieties were tested at the two sites. They were arranged in a randomized complete block design and replicated four times. Following planting, soil samples were collected from each plot and SCN egg counts were taken.

Varieties were monitored for plant growth, weed control and plant lodging. Prior to harvest, soil samples were again collected from each plot and analyzed for SCN eggs. Soybeans were rated for lodging and the plots were combined using a two-row plot combine from the Southern Experiment Station at Waseca.

Results

Yield and population development results are listed in **Table 1**. As can be seen by the data, variety performance was affected significantly by the level of infestation of SCN. Only three varieties, Dekalb cx235c, Dekalb cx202 and Pioneer 9182, ranked in the top thirty percent at both sites, based on yield. The average yield for the susceptible varieties was 36.5 bu/a and 24.3 bu/a for Kenyon and Geneva, respectively. The average yield for all resistant varieties was 38.5 bu/a at both sites. However at Kenyon, where SCN pressure was lower, ten resistant varieties yielded less than the average for the susceptible varieties. At Geneva, under high SCN pressure, only two resistant varieties yielded less than the average of the susceptible varieties.

Table 1 also shows the population information for SCN at both sites. At the Kenyon site, numbers were low and in some cases the initial populations (Pi) detected were so low that calculating the Reproduction Factor (Pf/Pi) was impossible, so only the final population densities (Pf) were reported.

Table 1. Soybean Yield and cyst nematode population development at infested fields in 1998.

				Kenyon		Geneva			
			Resistance	Low Nematode Pressure		High Nematode Pressure		Phytophthora	Chlorosis
		Maturity[a]	Source	Yield (Bu/A)	Pf[b]	Yield (Bu/A)	Pf/Pi[c]	Gene[d]	Score[e]
Freeborn	MPS	1.6	88788	36.8	153	32.1	0.80	Rps1a	MR
Faribault	MPS	1.9	209332	30.0	166	24.2	0.44	Rps1c	MS
Bell	MPS	2.2	88788	35.6	271	39.6	0.61	S	MR
Parker	MPS	1.5	s	32.6	3397	23.3	4.23	Rps1a	MR
Sturdy	MPS	2.1	s	42.7	3384	24.6	5.08	Rps1a	MS
9234	Pioneer	2.3	peking	39.8	50	32.6	0.54	Rps1a	MR
9182	Pioneer	1.8	88788	41.5	325	38.6	0.47	S	S
bt2161cn	Ziller	1.6	88788	36.7	463	28.8	0.59	S	ND
1882-1	Stine	1.8	88788	45.8	97	34.0	0.92	S	MS
1802	NorthStar	1.8	88788	37.6	838	40.9	0.61	S	MS
GL1559	Great Lakes Seed	1.5	88788	39.2	1581	23.3	2.96	Rps1a	ND
RS2297c	Renk	2.2	88788	35.6	341	26.1	0.46	S	ND
PB-215cn	Prairie Brand	2.2	88788	40.5	91	35.0	0.65	S	MS
PB-221-cn	Prairie Brand	2.2	88788	40.2	75	36.4	0.76	S	MS
188cn	Prairie Brand	1.8	88788	38.4	809	35.5	0.51	S	MS
S18-11	NK	1.8	88788	34.1	547	37.9	0.43	S	MS
3171	Thompson Seeds	1.7	peking	35.7	691	40.2	0.90	Rps1a	ND
3216	Thompson Seeds	2.1	88788/peking	35.3	122	37.8	0.80	Rps1a	ND
3236	Thompson Seeds	2.2	88788	41.7	113	34.4	1.04	S	MR
SOI201n	Sands of Iowa	2.0	88788	42.6	175	36.6	1.03	S	ND
5212N	Mycogen	2.1	88788	38.1	300	37.2	1.11	S	ND
IA 2036	IAES	2.2	88788	42.3	53	37.0	1.10	S	MR
A1901	Asgrow	1.9	s	34.2	2597	24.9	3.27	Rps1k	S
2201rr	Asgrow	2.2	88788	40.1	584	36.4	0.83	S	MS
2069	Asgrow	2.0	88788	39.6	347	38.0	1.48	Rps1k	MS
J770cn	Jacobson	2.0		36.0	156	35.3	0.79	ND	ND
cx235c	Dekalb	2.3	88788	43.8	94	38.2	0.53	S	MS
cx160c	Dekalb	1.6	88788	36.9	297	32.1	0.86	S	MS
cx202	Dekalb	2.0	88788	41.7	88	39.7	0.92	S	MS
2212scn	Kruger	2.0	88788	35.9	413	36.9	1.38	Rps1a	MS
2220scn	Kruger	2.0	88788	42.9	225	35.2	0.45	Rps1k	MS
352cn	Lathum	1.9	88788	40.7	200	31.8	0.31	S	MS
522cn	Lathum	2.1	88788	39.8	163	33.3	0.66	S	MS
1309cn	Croplan	1.3	88788	36.1	356	38.0	0.69	S	MR
1722cn	Croplan	1.7	88788	35.0	231	37.7	0.68	ND	ND
2102cn	Croplan	2.1	88788	37.2	128	33.7	0.69	ND	ND
LSD (P=0.10)				4.6	1283	6.9			

[a] Data supplied by seed company.
[b] Nematode density at harvest (eggs/100cc soil).
[c] Reproduction Factor (nematode density at planting/nematode density at harvest).
[d] From "Minnesota Varietal Trials Results, 1998", or supplied from seed company. S = susceptible, ND = no data.
[e] From "Minnesota Varietal Trials Results, 1998". S = susceptible, MS = moderately susceptible, MR = Moderately Resistent, ND = no data

SCN Resistant Varieties/Continued

Final populations showed nearly a tenfold increase when SCN susceptible varieties were grown. Susceptible varieties averaged 2739 eggs/100cc soil, whereas resistant varieties averaged 280 eggs/100cc soil. At the Geneva sight, egg numbers were significantly higher to begin with and the reproduction factor is given for each of these varieties. The Pf/Pi number is an indication of the ability of the nematodes to reproduce on the variety even though it is resistant. Pf/Pi numbers that are above 1.0 indicate that reproduction and an increase in numbers of eggs took place. Pf/Pi numbers less than 1.0 indicate that reproduction on the roots was minimal and that a reduction in egg numbers took place over the season. While resistant varieties had a reproduction factor of 0.8, the susceptible varieties had a reproduction factor of 3.88. In both of these locations, the plots with the susceptible varieties will have considerably more SCN pressure when the next soybean crop is planted. Choosing a variety that yields well and has a low reproduction factor should be a goal for soybean growers with moderate to high levels of SCN in their fields.

Table 2 shows yields, increase in yield above the susceptible average and increase in returns for the top 30 percent of varieties, based on the average yields for Kenyon and Geneva. The average increase for these varieties over the susceptible varieties was 5.7 bu/a and 12.9 bu/a at Kenyon and Geneva respectively. This translated into an increase in returns of $31.00 to $71.00 per acre at these sites, respectively. Overall, the range of increased returns was $6.05 per acre up to $84.70 per acre. Using the overall average increase of 9.3 bu/a, this would translate into about a $51.00 per acre advantage for a soybean grower using a resistant variety in a field infested with SCN at moderate to high levels.

While this is only one year's information, research from the University of Minnesota shows that over a three-year period from 1996-98, similar results have been achieved. It is safe to say that soybean growers that have moderate to high levels of SCN infestation will see yield and economic gains from using a SCN resistant variety. Choosing a resistant variety from the top 30 percent of varieties tested will produce results similar to those achieved in our tests

Table 2. Yields, yield increase above susceptible average yields and increase in returns per acre for Kenyon and Geneva sites for the highest yielding 30% of varieties.

		Kenyon			Geneva			Average		
			Yield Inc.	$ Increase		Yield Inc.	$ Increase		Yield Inc.	$ Increase
Variety	Company	Yield	over susc.	over susc.*	Yield	over susc.	over susc.*	Yield	over susc.	over susc.*
Ave of Susc.	Varieties	36.5	na	na	24.3	na	na	30.4	na	na
CX235C	DEKALB	43.8	7.3	$40.15	38.2	13.9	$76.45	41.0	10.6	$58.30
CX202	DEKALB	41.7	5.2	$28.60	39.7	15.4	$84.70	40.7	10.3	$56.65
9182	PIONEER	41.5	5.0	$27.50	38.6	14.3	$78.65	40.1	9.7	$53.35
1882	STINE	45.8	9.3	$51.15	34.0	9.7	$53.35	39.9	9.5	$52.25
IA2036	IAES	42.3	5.8	$31.90	37.0	12.7	$69.85	39.7	9.3	$51.15
SOI201N	SANDS OF IOWA	42.6	6.1	$33.55	36.6	12.3	$67.65	39.6	9.2	$50.60
1802	NORTH STAR	37.6	1.1	$ 6.05	40.9	16.6	$91.30	39.3	8.9	$48.95
2220SCN	KRUGER	42.6	6.1	$33.55	35.2	10.9	$59.95	38.9	8.5	$46.75
3236	THOMPSON	41.7	5.2	$28.60	34.4	10.1	$55.55	38.1	7.7	$42.35
Ave. Top 30%		42.2	5.7	$31.23	37.2	12.9	$70.83	39.7	9.3	$51.15

* Returns are calculated at a price of $5.50 per bushel based on the increase over the susceptible variety yield. All calculations are on a per acre basis.

Index of 1998 Topics Available

George Rehm, Extension Soil Scientist

We've had a request to put together an index of topics which appear in *Minnesota Crop News*. This was a reasonable request and the index for topics which appeared in 1998 is available. However, there is not enough money in the bank to send to everyone on the mailing list. Please let me know if you would like to have this index. My telephone number is:

Phone: (612) 625-6210
FAX: (612) 625-2218
E-Mail: grehm@extension.umn.edu

Soil Testing Laboratory Web Site

George Rehm, Extension Soil Scientist

The University of Minnesota Soil Testing Laboratory has developed a web page. The address is:
http://soiltest.coafes.umn.edu
This page contains information regarding various aspects of laboratory procedures, fertilizer recommendations, etc.

Sampling Soils For Nitrate-Nitrogen

George Rehm, Extension Soil Scientist

Sampling soils for measurement of nitrate-nitrogen is a recognized Best Management Practice for fine-tuning of nitrogen fertilizer recommendations. A soil sampling procedure for measurement of nitrate-nitrogen has been in use for western Minnesota for several years. There is now a soil nitrate test that can be used in south central, southeastern, and east central Minnesota. Directions for both sampling procedures are given in detail in University of Minnesota Extension Service Folder FO-7310. This publication is available at County Extension Offices Across the state. The title of the publication is, *Using The Soil Nitrate Test in Minnesota.* This publication should help in fine-tuning nitrogen fertilizer recommendations.

Vegetable Seed Germination and Soil Temperatures

Terry Nennich Clearwater County Extension Educator

Vegetables vary greatly in its response to soil temperatures when germinating. Planting into soils cooler than recommended temperatures may cause drastic stand reductions. The longer seeds are in the soil before germination or the slower the germination, the greater the chances are for soil disease and insects to attack the seeds. Some seed such as celery will not germinate above 75 degrees and have a very narrow temperature germination range. Most cucurbits (pumpkins, squash, melon) should not be planted before 55 degrees soil temperatures or permanent damage to plants may occur. The chart below shows the number of days it takes for different vegetable seeds to germinate at different soil temperatures. NG means no germination. Germination temperatures derived from *Knott's Vegetable Grower's Handbook.*

	Soil Temperature Degrees F								
Vegetable	**32**	**41**	**50**	**59**	**68**	**77**	**86**	**95**	**104**
Asparagus	NG(1)	NG	53	24	15	10	12	20	28
Lima bean	-(2)	-	NG	31	18	7	7	NG	-
Snap bean	NG	NG	NG	16	11	8	6	6	NG
Beet	-	42	17	10	6	5	5	5	-
Cabbage	-	-	15	9	6	5	4	-	-
Carrot	NG	51	16	12	7	NG	NG	NG	-
Cauliflower	-	-	20	10	6	5	5	-	-
Celery	NG	41	16	12	7	NG	NG	NG	-
Sweet corn	NG	NG	22	12	7	4	4	3	NG
Cucumber	NG	NG	NG	13	6	4	3	3	-
Eggplant	-	-	-	-	13	8	5	-	-
Lettuce	49	15	7	4	3	2	3	NG	NG
Muskmelon	-	-	-	-	8	4	3	-	-
Okra	NG	NG	NG	27	17	13	7	6	7
Onion	136	31	13	7	5	4	4	13	NG
Parsley	-	-	29	17	14	13	12	-	-
Parsnip	172	57	27	19	14	15	32	NG	NG
Pea	-	36	14	9	8	6	6	-	-
Pepper	NG	NG	NG	25	13	8	8	9	NG
Radish	NG	29	11	6	4	4	3	-	-
Spinach	63	23	12	7	6	5	6	NG	NG
Tomato	NG	NG	43	14	8	6	6	9	NG
Turnip	NG	NG	5	3	2	1	1	1	3

Soil Moisture Improving

Mark Seeley, Extension Agricultural Climatologist—Soils

Only about a third of the way through April, and most places have already recorded more days with measurable precipitation (5-7) than the entire month of March (3-5). Not only that, but the precipitation has fallen at the right time to help remove the remaining frost in the soil and to infiltrate into the shallow root zone where it will be available for germinating crops later in the month. By all estimates, most soils around Minnesota have normal to above normal moisture recharge to a depth of five feet. In some central and northern growing regions there is still a shallow layer of frost, which will undoubtedly disappear soon.

Soil temperatures are beginning to warm up nicely. Evidence of this can be found in the table at right, showing mean soil temperatures at the 4 inch depth on April 8th and the increase over the previous week.

Coarse textured soils and some tile-drained soils have warmed to above 50 degrees F at the 4 inch depth on several recent afternoons. With further drying, they will likely average above 50 degrees F within a week or so. Soil temperature will not be a factor in holding up field preparation or planting this spring, however it would appear that farmers may have to work around frequent shower activity during the month of April, especially in southern Minnesota counties.

Location	Mean 4 inch Soil Temperature (deg F)	Change from the previous weeks mean value (deg. F)
Becker	48	+5
Staples	45	+5
Morris	43	+6
Crookston	37	+3
Grand Rapids	43	+7
Park Rapids	41	+4
Princeton	47	+4
Rice	43	+6
Lamberton	46	+5
Waseca	46	+5
Rosemount	43	+5
St. Paul	47	+7

Weekly Crop/Weather Reports to Start

Mark Seeley, Extension Agricultural Climatologist—Soils

The weekly crop/weather report for Minnesota begins the week of April 14th. Compiled and released by the Minnesota Agricultural Statistics Service, this report provides updates on field preparation, planting progress, soil moisture conditions, temperatures, precipitation, and growing degree days. Although many subscribe to this service in printed form, it is available over the Internet as well at the following web site.

http://www.nass.usda.gov/mn/homepage.htm

In addition, the weekly crop/weather reports from neighboring states can be found at the USDA National Agricultural Statistics Service web site at the following address.

http://www.usda.gov/nass/

These sites may be accessed each Monday afternoon to obtain updated reports throughout the 1999 crop season.

New Crop Protection Labels for Canola

Carlyle Holen, IPM Specialist
Erv Oelke, Extension Agronomist

Canola has long been a crop with a limited registration of pesticides to manage crop pests. This has changed rapidly in the past few months with both full federal registrations and new and pending Section 18 registrations of herbicides, fungicides and insecticides. The current products with full labels on canola are:

Herbicides—Assure II, Poast and Treflan.
Insecticides —Gaucho (seed treatment) and Ethyl-methyl parathion
Fungicides—Captan (seed Treatment), Benlate (seed treatment, and Quadris (new label in 1999)

Quadris is a broad-spectrum fungicide with activity on sclerotinia, blackleg and alternaria black spot. Use rates are 6.2 oz of product for blackleg control and from 9.2 to 15.4 oz of Quadris per acre for sclerotinia suppression. The principal use of Quadris in Minnesota is likely to be for suppression of sclerotinia. Trials conducted in North Dakota in 1998 by McKay, Lamey and Knodel (**Table 1**) show Quadris is an effective fungicide against this plant disease.

The following compounds have received Section 18's for 1999:

Warrior—this insecticide was granted a temporary label for control of flea beetles. Use rates are from 2.6 to 3.8 oz product/acre with a maximum of 7.7 oz product/acre/season. Warrior has excellent activity on flea beetle, but timing of postemergence applications is crucial, as stands can be lost in a few days if flea beetle pressure is high. Defoliation on seedlings should not be allowed to exceed 50%. Weather conditions play a large role in determining the intensity of feeding by flea beetles and warm dry conditions from emergence through the cotyledon stage are the highest risk times for the crop.

Stinger—has received a temporary label for control of Canada thistle and perennial sowthistle in canola. Use rates are from 0.33 to 0.5 pts of product/acre with only one application allowed during the growing season. Trials conducted by Bill Lueschen, former weed scientist with the U of M, have show that canola has good tolerance to Stinger at these use rates.

Table 1. Sclerotinia control with Quadris on canola.

Treatment	Rate	Timing	Sclerotinia % incidence	Yield
	oz product	% bloom		lbs/acre
Untreated	--	--	53.5	1784
Untreated	--	--	52	1773
Quadris	6.8	20	6.5	1898
Quadris	9.6	20	16	2057
Quadris	13.6	20	10.5	2059
Benlate	14	20	3.5	2004
LSD (0.05)			16	167

Location: Newberg, ND.

Sonalan—received a Section 18 for control of kochia in canola. Use rates are 5.5 to 11.5 lbs of Sonalan 10G per acre or 1.5 to 3 pts of Sonalan HFP per acre with only one application allowed per crop year. One application per crop year means one application in the spring of 1999 for the 1999 canola crop and could also include one application in the fall of 1999 for the crop grown in 2000. Trials conducted by Bill Lueschen, et al. have shown that canola has less tolerance to Sonalan than Treflan, which may result in stand loss and reduced yields (**Table 2**).

Table 2. PPI herbicides on canola at Roseau and St. Paul in 1997.

Herbicide	Rate	Canola injury		Stand reduction		Yield	
		Roseau	St. Paul	Roseau	St. Paul	Roseau	St. Paul
	pts	----------	----------	%	----------	----------	lbs/acre
Treflan	2	13	25	25	17	1251	1426
Sonlan	2.5	33	32	34	38	1092	1418
Check (Poast)		8	15	15	16	1518	1335
LSD (0.05)						263	137

Muster-has been granted a temporary label to control wild mustard in canola grown **only** for seed production. The use rate is 0.3 oz of product per acre. Use of the treated seed to produce canola oil or to graze livestock is prohibited.

Herbicide tolerant canolas are an innovation that will make weed control easier and more consistent (and maybe more expensive, be sure to compare all costs of conventional versus herbicide tolerant weed control programs). Raptor, Liberty, and Roundup all have Section 18 labels for use on tolerant varieties in 1999. **Table 3** shows use rates, available tolerant varieties, and suggested additives for use on canola.

Table 3. Herbicide tolerant canola

Herbicide	Use rate	Tolerant varieties	Additives
Raptor	4 oz	45A71	1 qt nonionic surfactant and 1 qt 28% N
Liberty	34 oz	Phoenix, Invigor 2373	3 lbs AMS
Roundup Ultra	16 oz	8-12 varieties	-----

Section 18 requests for one additional herbicide (Herbicide 273) and fungicide (Ronilan) are still being evaluated.

Will This Be The Year of a Black Cutworm Outbreak? Pheromone Traps Available!

Ken Ostlie, Extension Entomologist

Each year, black cutworms migrate north from the Gulf coast and southern Texas. Weather patterns dictate when these migrations take place and where the moths end up. Consequently, outbreaks are relatively unpredictable year to year. Fortunately, Minnesota is on the northwest corner of potential migratory routes, so outbreaks have been infrequent. The last major outbreaks occurred in 1985-1986. Don't let this historical infrequency lull you into complacency. Each year presents a new set of weather patterns and a renewed threat of a black cutworm invasion. There is a growing concern that warming trends could lead to earlier northward movement of the storm track (jet stream) and open Minnesota up to more black cutworm.

These migratory flights of black cutworm can be tracked using pheromone traps. Over the last 15 years, the IPM program has fielded a network of pheromone traps with the help of 80 or more cooperators per year. The pheromone traps, which detect arriving males, can help pinpoint significant IPM programs and will again provide up to 100 taps, free of charge, to anyone who would like to monitor black cutworms. If you are interested in monitoring black cutworms from now until late May, contact me as soon as possible by

PHONE (612) 624-7436,
FAX (612) 625-5299
OR E-MAIL: kostlie@extension.umn.edu

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CROP NEWS

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

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Where, O Where, has my (Fall) Nitrogen Gone?

Mike Schmitt, Extension Soil Scientist

As spring arrives, one concern many people have regards the fate of their fall anhydrous ammonia or urea applications, especially considering the extremely long and mild fall. I vividly recall N being applied in December!

Let us keep in mind some basic principles as we address this question this spring. First, the issue of nitrification (conversion of ammonium N to nitrate N) is much different than N loss. Nitrogen in the ammonium form is not vulnerable for loss. However, nitrifying bacteria in all soils gradually convert ammonium to nitrate. This process is directly related to soil temperature and the length of time the ammonium is exposed to these temperatures. With NORMAL fall temperatures, applying ammonium N when soil temperature are 50F minimizes nitrate accumulation although some conversion still occurs. Applying fall N early (when soil temperatures are significantly above 50F) and/or when the fall soil temperatures stay above 32F for an extended period of time—like last fall—the amount of ammonium conversion to nitrate is significantly greater. But, conversion to nitrate N should NOT be considered lost.

Two main processes result in the loss of nitrate N in the soil. While leaching of nitrate N is an N loss mechanism, our Best Management Practices (BMPs) clearly state that on soils where leaching is a concern, fall N should not be applied (southeast MN, sandy soils). Denitrification is the other loss process. This is a biological process that likes saturated soil conditions, a source of nitrate N, and warm soil temperatures. Generalizing, denitrification is not an important process until after the soil warms late in the spring and throughout the summer.

So, what about last fall's fertilizer N? At this time, a greater percentage of nitrate N has accumulated compared to other years. If your N was applied earlier than recommended or if urea was your N product, the accumulation of nitrate is also probably higher. Thus, the potential for N loss later this spring will be greater than normal. It is unlikely that any fall N has been lost so far nor will be lost during the early spring as soil temperatures are not conducive to dentrification.

The critical time for evaluating potential N management strategies for the 1999 corn crop will be the first part of June. At that time, the soil moisture status and growing conditions will be known and the Universit of Minnesota's Supplemental N Worksheet will be a key tool in determining whether significant N losses may have occurred. The decision of applying supplemental N should wait until June.

In this issue

The Rotation Effect And Nitrogen Credits

George Rehm, Extension Soil Scientist

There's no question that the use of crop rotations is a good management practice. In Minnesota, the large majority of crop acres are part of one of a variety of crop rotations. There is ample evidence from past research to document the positive impact of crop rotations on yield. Crops that follow legumes in rotation benefit from the rotation effect as well as the nitrogen credit from the previous legume. The nitrogen credit is important because it reduces the amount of fertilizer nitrogen needed by crops such as corn and wheat. This saves dollars and reduces the potential for movement of nitrate-nitrogen (NO_3-N) to the groundwater.

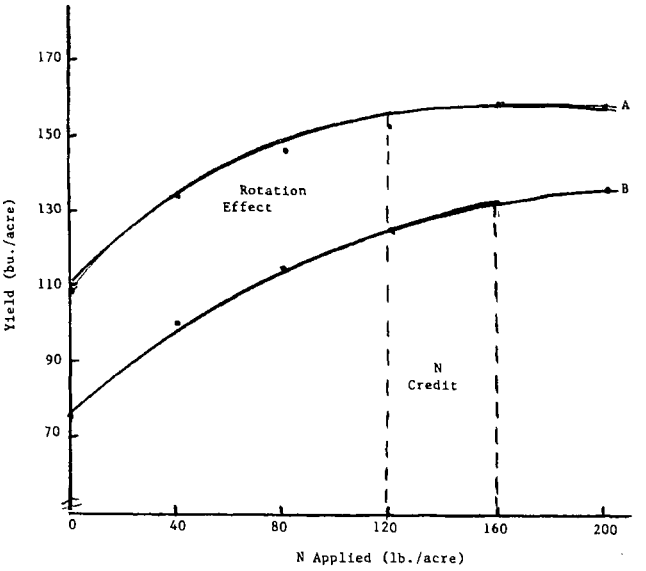
Frequently, growers are confused by the terms, "rotation effect," and "nitrogen credit." The results from a long-term study conducted at the Southern Experiment Station, Waseca, provide evidence for a clear distinction between these two terms. The study was conducted for 12 years beginning in 1975. Five rates of nitrogen (40, 80, 120, 160, 200 lb. N per acre) were applied to corn in either a corn/soybean or continuous corn sequence. A control (no applied fertilizer nitrogen) was included in the study.

The results of the study are summarized in **Figure 1**. These results are the averages for the 12 years. When averaged over the years, the application of 120 lb. nitrogen per acre was optimum when corn followed the soybean crop (curve A). For continuous corn (curve B), the use of 160 lb. nitrogen per acre produced the optimum yield. The difference between optimum nitrogen rates is referred to as the "nitrogen credit" for soybeans.

N credit = (160 lb. N/acre, continuous corn) -
(120 lb. N/acre, soybeans/corn) = 40 lb. N/acre

At each rate of applied nitrogen, the yields from corn following soybeans were higher than yields when corn followed corn. This increase varied with the rate of nitrogen applied, but averaged about 18%. This yield increase is referred to the "rotation effect." This "rotation effect" is the difference between curves A and B. The "rotation effect" persisted even though the rate of applied nitrogen was 200 lb. per acre.

Figure 1. Effect of rate of fertilizer N on corn yield in a soybean/corn (A) and continuous corn (B) cropping sequence.



The basis for the "rotation effect" has not been clearly defined. There are several possibilities that have not been completely documented.

Recent research has shown that the "nitrogen credit" is not due simply to the nitrogen incorporated from the legume crop. Other factors are involved. The previous legume has been shown to improve soil structure and water infiltration. Improvement of these and other soil properties can increase corn yields.

The corn/soybean rotation has been a popular fixture in Minnesota agriculture for many years. There are many positive benefits. Even though commodity prices are low, there is little benefit from moving away from the rotation.

Field Peas in the Rotation

Hans Kandel, Red Lake County Extension Educator
Ervin Oelke, University of Minnesota Extension Agronomist

Field peas added into the crop rotation will break the scab and root rot disease cycles, add nitrogen to the soil, and mellow the ground. Field peas are an early cool season crop to be seeded from late April to mid-May. Peas can withstand mild frost without damage, especially if the plant has been exposed gradually to lower temperatures. Seeding rates are 170-180 pounds per acre for large-seed varieties, 150-170 pounds per acre for medium seeds, and 120 pounds per acre for small-seed varieties. Aim for a population of eight plants per square foot. Peas can be planted on nearly all soil types but soil should be well drained. Using regular wheat seeding equipment plant at a depth of about 2 inches.

Peas may have a yellow or a green seed coat. Yellow peas have a slightly higher yield, but green are preferred for the human consumption market. Currently there are two plant types available: standard long-vined full leaf, or shorter, earlier maturing, semi-leafless types. 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. A nitrogen credit for the subsequent small grain crop, as a rule of thumb, is about one pound of nitrogen per bushel of peas produced.

The table shows results from the 1997 and 1998 seasons for Red Lake Falls, Oklee, Fosston, Kennedy, and Baudette. Among the varieties tested Majoret and Astuce have a green seed coat. For more information call Hans Kandel at 1-800-770-1244.

Table: Minnesota pea variety trial results 1997 - 1998 data. Yields are expressed in bushels per acre.

Pea variety	RLF 1997	Fosston 1997	Oklee 1997	Kennedy 1997	LOW 1998	RLF 1998	Fosston 1998	Mean 97-98	Mean RLF-Fos98
Spitfire	54.6	68.2	57.2	51.3	73.2	74.5	66.4	63.6a*	70.5
Carneval	39.7	69.8	41.8	56.9	64.6	62.5	71.7	58.1ab	67.1
Grande	46.5	59.8	63.1	53.8	58.2	49.1	67.7	56.9ab	58.4
Highlight	50.3	50	49.2	63.4	62.4	62.7	49.9	55.4ab	56.3
Carrera	40	57.4	41	51.6	73.1	60.7	60.6	54.9b	60.7
Mustang	39.4	56.9	50.5	58	55.7	56.8	48	52.2b	52.4
Majoret	42.6	56.4	39.1	43.6	67	54.6	61	52b	57.8
Profi	39	52.1	33.6	47.2	72.	53.5	48.2	49.5b	50.9
Astuce						67.6	46.3		57
North X	39.4	49.5	40.2	50.9	66.2				
Trapper	30.5	25.7	19.5	39.1	42.2				
Mean	42.2	54.6	43.5	51.6	63.5	60.2	57.8		

RLF = Red Lake Falls, MN
LOW = Baudette, MN (Lake of the Woods County)
** Values in the column followed by the same letter are not significantly different at P<0.10*

Problems Associated with Continuous Soybeans

Bruce Potter, Extension IPM Specialist, SW Exp. Station

Current low crop prices, loan rates, and high production costs may have farmers considering planting a second year of soybeans in some fields. This may appear to be a good option after the initial pencil pushing but should be examined more closely. Although production costs may be lower, there is a good chance that yields may be lower as well. Additionally, producers may be setting themselves up for long-term management headaches. We have two major concerns, disease problems and weed species shifts.

Yield potential

It is not a certainty that a second year of soybeans will yield poorly, although this behavior does tempt fate. Organisms that parasitize soybeans are a major concern. Three problems that immediately come to mind are white mold, brown stem rot, and soybean cyst nematode (SCN). They are well documented to be greater problems in continuous soybean, and we already have enough to go around. White mold and soybean cyst nematode persist in the soil. Brown stem rot overwinters and can also live as saprophyte on soybean residue.

A few other organisms that survive the winter on residue include those causing bacterial blight, bacterial pustule, anthracnose, stem canker, pod and stem blight, brown spot, etc. Soybeans on soybeans benefit these organisms as follows: the first year of soybeans allows reproduction and buildup of disease inoculum and nematode populations, the second year of soybeans is planted into the elevated disease or nematode levels.

Without a non-host year, reduction of plant parasitic organisms from exposure, natural enemies, and old age is minimized. Yes, there can be a free lunch for soybean diseases. The right environmental conditions for disease development are always required. The higher the parasite levels, however, the greater the potential for yield loss. A piece of good news is that some root rot causing pathogens (Phytophthora, Fusarium, Pythium, and others) are already prevalent in the soil and a few more probably won't make a major difference.

How to Develop a Chronic Problem

More than yield in the current soybean year should be considered. This aspect is especially troublesome for persistent organisms like white mold and SCN. These organisms are engineered to survive for long periods without a host (i.e., the sclerotia of white mold and the cyst-protected eggs of SCN). Weed problems have similar long-term implications. You have increased your chances of a problem in future years if these populations are allowed to increase in the second year of soybeans.

Weed species shifts, or the increase of a particular weed species in the population of a field because it escapes by herbicide tolerance or time of emergence, have been known to occur. The increase of waterhemp is one example. By planting the second year of soybeans and applying the same herbicide or cultural practices, you are helping speed the selection process along. In other words, you are providing a weed species that escaped the first year another chance to out compete the competition. You are doing an efficient job of selecting for weeds that like the way you farm. From a twisted ecological perspective, your field wants to have weeds growing in it. The objective is to prevent a buildup of these weeds that are hard to control.

Suggestions if you have no other choice

Maximize the disease defensive characteristics in the varieties planted. Varieties with lower susceptibility to white mold and brown stem rot should be selected. Resistance to soybean cyst nematode is critical in fields with a history of this pest. Rotate the source of resistance if SCN resistance is used both years (see weed species shifts above).

Continuous Soybean Problems/Continued

Continuous soybeans in a SCN problem field are akin to bungee jumping without tying off the rope. We are still looking for a documented case of SCN resistance failure in Minnesota.

Try to use a different weed control program than the previous year. Rotate chemical families/modes of action.

Clean and test any saved seed. A seed treatment may be appropriate, depending on the disease, if you suspect that the seed may be infected.

Moldboard plowing may help control some (but not all) of the fungi and bacteria that survive on residue. Unfortunately, heavy tillage of soybean residue has other negative impacts and spring moldboard plowing is not advisable in this part of the world.

Soybean Seed Protection

Dave Schwartz, McLeod County

Seeds planted under cool, moist conditions are more susceptible to a number of soil pathogens. According to *Minnesota Ag Statistics*, approximately 25% of the soybean acreage in Minnesota is planted by May 15. Depending on planting conditions, planting may begin as early as the last week of April, thus was the case in 1998. Growers and researchers are asking more questions about the value of seed treatment for early planted soybean fields. This is even more critical now with the addition of Roundup Ready soybeans. Seed cost per acre has risen dramatically in southern Minnesota ($22 to $40 per acre depending on seed size and plant population) where the majority of soybeans in 1999 will be Roundup Ready. As the price of seed increases, growers are interested in knowing if a fungicide treatment is necessary to protect their seed investment.

University of Wisconsin research conducted by E.S. Oplinger, J. M. Gaska, and C. R. Grau found positive results from seed treatment, especially when soybeans are planted in no-till or reduced till environments. Their research documented both improved stand establishment and improved yields. For example, when soybeans were no-till drilled in 7.5 inch rows into corn stalks, the average increase in plant population when seed was treated with Rival was +19% and yield averaged +12% compared to the control over a six year period. **Table 1** has results of that data comparing several products over the six year period.

Table 1. Soybean response to seed applied fungicides planted in early May under no-till conditions. Wisconsin 1992-1997

Years	Fungicide Treatment	Yield bu/a	Yield % change	Population/[1] K/acre	Population/[1] % change
1992-97	Control	54.5		118	
	Rival	61.0	+12	141	+19
1992,93,95-97	Control	52.6		106	
	Rival	59.7	+13	128	+21
	Rival +Apron FL	56.1	+7	123	+16
1997	Control	50.8		96	
	Rival	55.0	+8	129	+34
	Rival+Apron FL	55.1	+8	108	+12
	Rival+Apron XL	56.2	+11	92	-4
	Vitavax TL	59.1	+16	90	-6
	Apron XL	56.9	+12	99	3
	Apron XL+Maxim 4FS	61.9	+19	132	+37
	Apron XL+Thiram	52.8	+4	93	-3
	T-22	59.3	+17	115	+19
	LSD 10%	4.7		20	

[1]*Soybeans were drilled in 7.5 rows May 1 to May 5 each year at 225,000 viable seeds/acre, no-till into undistributed corn stalks.*

Six on-farm studies in Wisconsin were conducted in 1997 and 1998 testing seed treated with Rival. Three of the farms practiced conventional tillage, two minimum tillage, and one no-till. Researchers C. R. Grau, E. S. Oplinger, and T. S. Maloney found an average 2.1 bushel yield advantage when seed was treated with Rival compared to non-treated seed.

It is difficult to find one product that will provide protection for all seedling diseases. This is why it may be beneficial to use a combination of fungicides for more complete coverage. (See **Table 2** for fungicide comparison chart.) For best results, its recommended to have the seed treated commercially at the plant before seed is bagged, since uniform coverage is very important and difficult to accomplish on the farm. The cost of seed treatment varies from $1 - $2 acre depending on the products used. Some seed companies, such as Dekalb, are treating a small percentage of their seed in 1999 and reminding their customers that the seed must be planted. Treated seed cannot be returned to Dekalb, fed, or sold at the local elevator, so growers need to understand these terms when making their seed order.

The effectiveness of seed treatment depends a great deal on planting date, soil type, and the tillage system being used. In general, the earlier that soybeans are planted in cool, poorly drained soils, the more likely growers are of seeing an economic benefit when planting treated seed. Seed treatment is probably not for everyone, but growers who are planting full season varieties in late April or the first week of May will most often benefit by the $1 to $2 investment in seed treatment.

Table 2. Active ingredient and specific activity of soybean seed fungicides

Active Ingredient	Trade names	Pythium	Phytoph-thora	Rhizoctonia	Fusarium
metalaxyl	Apron formulations	excellent	excellent	no activity	no activity
captan	many	good	poor	good	fair
captan + PCNB + Thiabendazole	Rival	poor	poor	good	excellent
carboxin + thiram	Vitavax-200	poor	no activity	fair?	Poor
carboxin + captan	Vitavax-captan	fair	poor	good	fair
PCNB + ethazole	Terraclor Super-X Terra-Coat L-205N	good	poor	good	poor
thiram	many	fair	poor	good	fair

University of Wisconsin, Craig Grau, Department of Plant Pathology

Applying Urea For Wheat With Air Seeders

Albert Sims, Soil Scientist, Northwest Experiment Station
George Rehm, Extension Soil Scientist

The development of air seeders has provided crop producers with a new technology that allows for the application of both seed and fertilizer in one field operation. This combination can save one trip over the field with subsequent savings in time and machinery costs.

Past experience has shown that phosphate fertilizers can be applied in contact with wheat seed without any harm to germination, emergence and crop yield. There were, however, questions about the use of urea with the air seeder. Many growers were concerned about the rate of urea that could be applied either near or in contact with the wheat seed.

In an effort to provide answers to this major concern, studies were conducted near Crookston in 1997 and 1998 to evaluate the effect of several rates of N (supplied as 46-0-0) applied either near or with the seed on emergence and yield of wheat planted with an air seeder. The soils at the experimental sites were typical of those in Northwest Minnesota.

Three placement options were used in 1997. An additional option was added in 1998. For 1997, the three options were:

1. 46-0-0 applied in a band to the side of, and below the wheat planted in a narrow band (BB)
2. 46-0-0 placed in a band between 2 wheat rows spaced about 3 in. apart (TB)
3. 46-0-0 mixed with the wheat and both are placed in the soil in a narrow band (BM)

In 1998, the additional placement option was the mixture of the 46-0-0 and wheat placed in the soil in a broad

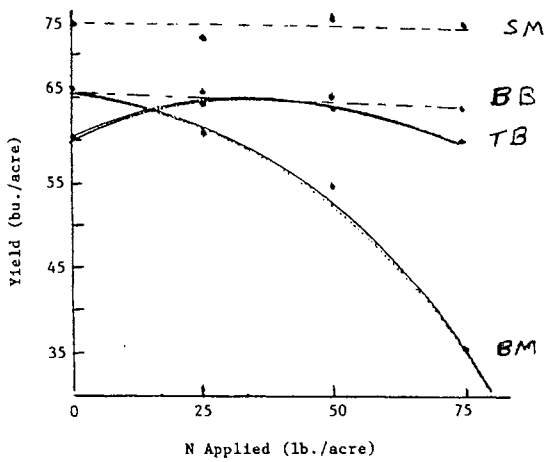


Figure 1. Wheat yield resulting from four seed-fertilizer N placements at four N rates.

Applying Urea/Continued

band (SM). Urea was applied at rates to supply 25, 50, and 75 lb. N per acre. There was a control (no applied N at seeding). The total amount of N applied for each treatment was 140 lb. per acre. The amount not applied at the time of seeding was broadcast and incorporated before planting.

There was a substantial difference in soil moisture content. The soil was wet with ample moisture in 1997. The soil at the test site was extremely dry at planting in 1998.

The early season stand counts and wheat yields for 1977 are summarized in **Table 1**. The placement of the fertilizer and the wheat, and the rate of N applied with each placement had no effect on emergence and yield. Except for the situation where 50 lb. N per acre was mixed with the seed, the use of N at the time of planting produced small increases in yield when compared to the control. With ample moisture in the seed zone, there was no seed damage from the applied urea.

Table 1. The effect of rate of N applied as urea and placement on plant stand and yield of wheat. 1997.

Seed-Fertilizer Placement	N Applied at Planting lb./acre	Emerged Stand plants/ft²	Grain Yield bu./acre
urea band			
beside seed (BB)	0	22	38.3
	25	19	45.6
	50	23	43.4
	75	22	41.4
twin row (TB)	0	22	40.3
	25	23	45.7
	50	22	44.0
	75	22	42.2
urea with wheat	0	23	40.1
in narrow band	25	23	42.3
	50	21	40.2
	75	23	45.8

The soil was very dry when wheat was planted at the experimental site in 1998. Results were different from those measured in 1997 (**Figure 1** on page 21). Yields decreased as the rate of applied N increased when the 46-0-0 was mixed with the seed and placed in a narrow band. The mixture of urea and wheat in a broad band (SM) decreased stand but did not decrease yield. With emerged population reduced, the number of tillers probably increased.

The results of these two years indicate that mixing 46-0-0 with wheat seed is a low risk management practice if there is ample soil moisture at planting. Risk of damage from this N fertilizer increases in dry soils.

Potassium Soil Test Levels in Southeast Minnesota

Tim Wagar, Area Extension Educator
(*) Roger Eliason, Director, U of M Research and Soil Test Laboratory

Potassium (K) deficiency in corn is a common plant symptom found in fields of southeast Minnesota. Affected corn plants are stunted, light green, and the margins of the lower leaves have a burnt or scorched appearance. Deficient areas have uneven growth patterns that may be found throughout the entire field. Often times K deficiency in corn is mistaken for nitrogen deficiency or herbicide damage. This can be verified by soil sampling the suspected area and comparing the results to a soil sample taken from an area of normal growth. The primary reasons for K deficiency in corn are: 1) not providing sufficient potassium (K) fertility for the crop and 2) the type of clay that is predominant in the silt loam soils of the region.

In this part of the state, the silt loam soil types were derived from loess parent material that was deposited by wind following the last glacial period. These soils contain a type of clay that will fix soil K, thereby reducing availability for plant uptake. (For those readers who subscribe to the *Ag Consultant* magazine, there is a great article about potassium in the October 98 issue).

With the above information in mind, it is important to have sufficient K soil fertility available for crop production. Based on soil testing activity at the U of M Soils Laboratory from 1990-1997(*), an average of 29% of the K soil tests for the southeast region were low, which is 80 ppm or less. Recent field trials conducted in the area have shown significant yield increases for corn grown on low K testing soils, when recommended potash rates were applied with the starter or broadcast fertilizer.

For farmers in southeast Minnesota with low K soil tests, starter or broadcast potash for corn would be a very good value considering the tight input budgets this year.

Managing Common Stalk Borer With Bt Hybrids

Fritz Breitenbach, IPM Specialist Southeast District
Tim Arlt, Extension Educator, Steele County

Bt corn hybrids may offer growers one more tool for managing common stalk borer. In 1998, a stalk borer trial was conducted in Steele County. The selected field had a history of stalk borer damage, the field also had a moderate to heavy population of giant ragweed (a known alternate host for common stalk borer). The trial consisted of 6 different treatments. Three corn hybrids—Pioneer 3751, its Bt iso-line Pioneer 36F30, and NK 3030 also a Bt hybrid—were used. The hybrids were planted such that plots could be treated with Warrior insecticide, and compared to an untreated plot. The Warrior was applied post-emergence along with a broadleaf herbicide for ragweed control (2-3 collar corn stage). The results of the trial are reported below.

In this trial Bt hybrids average 46 bushel more than the conventional corn hybrid P3751. Warrior insecticide numerically increased corn yields; however, these increases were not statistically different from the untreated plots. Corn population was also increased by an average of 12,651 plants per acre with the Bt hybrids. Warrior insecticide numerically increased corn plant population, however, these increases were not statistically different from the untreated Bt plots. There was a statistical increase in plant population with P3751 when treated with Warrior.

Common Stalk Borer Control With Bt Hybrids

Treatment	Rate	Plant Population baring plants/a	Yield bu/a
Pioneer 3751		13,742	52
Pioneer 3751 Warrior	3.2 oz/a	19,195	65
Pioneer 36F30 Bt		26,611	100
Pioneer 36F30 Bt Warrior	3.2 oz/a	29,447	121
Novartis NK3030 Bt	26,175	96	
Novartis NK3030 Bt Warrior	3.2 oz/a	29,229	103
LSD (P=0.10)		4,733	26

The results from this trial look very encouraging. A caution to producers is that this is a single trial, at one location. This trial was also looking at stalk borer larvae that were forced to move from ragweed because of a post emergent herbicide application. Stalk borer larvae moving out of fence rows or waterways may be larger in size and hence may not be as susceptible to Bt corn hybrids. This trial will be repeated in 1999 hopefully with similar results.

USDA Researchers Create Highly Aflatoxin-Resistant Corn

Contact: Jim Henry (301) 504-1611

Agriculture Secretary Dan Glickman has announced a new corn line developed by USDA scientists that outshines all previous corn lines in its ability to naturally fend off aflatoxin, a fungal toxin that poses a threat to humans and livestock. The corn line has been released to seed companies and public research institutions for breeding purposes.

This new corn line from scientists at USDA's Agricultural Research Service could be an important step toward the long-term goal of commercial hybrids with strong aflatoxin resistance.

Currently, commercial hybrid corn with aflatoxin resistance is not available to farmers.

The new corn line, named Mp715, has lower levels of infection with the fungus and subsequent contamination with aflatoxin. It will take several years before hybrids conventionally bred using Mp715 could be available.

NOTE: *Contact for details: W. Paul Williams, research leader, Corn Host Plant Resistance Research Unit, Agricultural Research Service, USDA, Mississippi State, Miss., phone (601) 325-2735, fax (601) 325-8441, pwilliams@dorman.msstate.edu.*

Plant Disease Clinic

Sandra Gould, Plant Disease Clinic

Samples that were submitted to the Plant Disease Clinic for analysis included:
wheat—cultured for storage molds
barley—tested for loose smut
sugarbeet—soil for *Aphanomyces* sp root rot index bioassay
crabapple—*Phytophthora* sp
geranium—tested for *Xanthomonas campestris* pv *pelargonii* (bacterial wilt) and tomato spotted wilt virus (TSWV) and impatiens necrotic spot virus (INSV)
E. lily—*Pythium* sp root rot
lupine—*Colletotrichum* sp stem rot
ajuga—alfalfa mosaic virus, cucumber mosaic virus
impatiens—INSV
veronica—*Botrytis* sp stem rot
sempervivum (hens & chicks)—INSV
aster—TSWV
allium—INSV
Other hosts that were tested for INSV and TSWV included: lamium, sedum, primrose, stachys (lamb's ears), phlox, heuchera, coreopsis, ajuga, corydalis, hibiscus, petunia, gerbera, dahlia, monarda, spikes, artemisia, scabiosa, penstemon

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CROP NEWS

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

Volume 5, No. 2 www.extension.umn.edu March 12, 1999

Crop Rotation Economics

Bob Byrnes
Lyon Co. Extension Educator

The depressed corn and soybean commodity price may impact planting and the traditional relation ship between corn and soybean production. Some estimates indicate that up to 30 percent of the nation's crop acreage is still undecided as to the intended 1999 crop. Some private crop marketing advisors are advocating shifting intended corn acres to soybean production. The idea is to increase soybean production and decrease corn production. The intended result will be to produce less bushels of corn to increase the corn price, and produce more soybeans which would drive down the market price to levels well below the established loan rate. Farmers would produce for the loan rate or the soybean loan deficiency payment. Those who advocate this strategy suggest that the lower soybean prices would discourage soybean production by our foreign competitors, primarily in South America.

So how would this strategy affect Minnesota farmers? The answer is likely complicated market, economic and agronomic factors. Market factors of supply and demand suggest that if the supply of corn produced is decreased, price should increase. Current corn price is below cost of production.

Economically, soybeans have lower input cost than corn. The largest factor in the lower production cost is fertility requirements (especially nitrogen) and crop drying expense.

Soybeans also perform better than corn in dry years. There are some who worry that La Nina or historic trends suggest that we are due for a drier than normal crop production year.

However, there are some very real agronomic challenges with this strategy. Planting more soybeans and

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less corn changes the balance of the crop rotation. The corn soybean rotation is used for pest management yield advantage. If 1999 soybean plantings occur on fields which grew soybeans in 1998, pest management and fertility needs to change with the changed rotation.

Pest management concerns with a soybean on soybean planting focus mainly of diseases. Brown Stem Rot, White Mold and Soybean Cyst Nematode are the main concerns.

Brown Stem Rot disease pathogens overwinter on soybean residue, which provides the inoculum for disease infection. In addition to the susceptible crop and disease inoculum, the right environmental conditions are necessary to actually have the disease. Management to avoid Brown Stem Rot involves planting a Brown Stem Rot resistant variety.

White Mold risk in the soybean to soybean rotation is increased if white mold sclerotia was produced in 1998, and if that sclerotia is near the soil surface. Management to avoid white mold problems involves avoiding nitrogen (including manure) application prior to soybean production, avoiding high soybean planted populations and selecting varieties with less susceptibility to white mold. White mold variety ratings are listed in the University of Minnesota Experiment Station *Variety Trials* which are available at the Extension Office.

Soybean Cyst Nematode (SCN) populations have the potential to increase greatly and reduce yield significantly in a soybean to soybean rotation. Use a SCN soil test to determine if the field is infested. In absence of a SCN soil test where soybeans have been grown in a corn soybean rotation for two or more decades, assume that the field may be infested. Plant a SCN resistant variety in soybean on soybean rotations.

Fertility is also an issue in soybean to soybean rotations due to the absence of the rotation yield effect, as well as the typical practice of applying the soybean fertility on the corn year. Rely on a soil test to provide any needed phosphate and potash. More information is available in the publication *Fertilizing Soybeans in Minnesota,* FS-3813, which is available at the Extension Office.

Corn Planting Depth

Bruce Potter
Extension IPM Specialist—SW Experiment Station

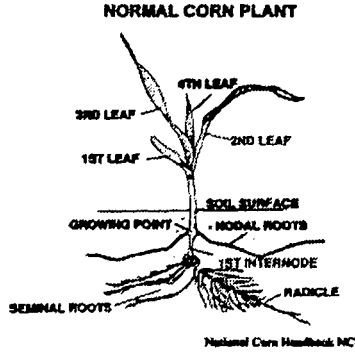
"Searching for Nirvana"

As planting season approaches, producers should be making repairs and adjustments to their corn planters. After the equipment adjustments are made and hybrids are selected it is wise to do a good job at seed placement. Planting will pay big dividends if done correctly and but can cause a lot of disappointment if done poorly. The benefits of early planting have been well discussed. Having to replant because of a poor stand or having to watch a nonvigorous stand struggle through the season is to be avoided.

A common mistake is poor seed placement with respect to depth. Some growers seem to be intent on planting at a magical one and one-half inch depth. Some are quite good at hitting it, at least temporarily. It is extremely difficult to plant a field uniformly at one and one-half inches. There are several reasons for this. Residue often bumps the depth of the unit(s) shallower. Loose seedbed conditions (but the field has never worked up this nice!) can easily settle one-half inch or more. One-pass spring tillage has created some extremely mellow soil conditions the past couple of springs. Seed depth that started out at one and one-half inches can easily be an inch or less after a good rain. The symptoms of this phenomenon are good corn in the wheel tracks and stunted corn in the rows off the tractor tires. If you try to plant at one and one-half inches you have a good chance (probably greater than 50%) of ending up too shallow. High-speed corn planting, faster than 5-6 mph, gets you done quicker but it also tends to lift the corn planter. High speed planting can also cause problems with spacing between seeds for some planters.

So what's the big deal?

There are several problems with shallow planted corn. The potential for poor root development is increased. Soil near the surface is prone to dry out and is exposed to greater fluctuations in temperature and moisture than soil at a greater depth. This means that root development is at risk from dry, hot, or cold conditions.



The seminal and nodal root (including brace root) systems can develop symptoms that look like herbicide or nematode injury (stunted, stubby and swollen) under these stressful conditions. Nodal roots are forced to develop close to the surface when corn is planted shallow. Development can be aborted if hot dry conditions occur where these roots are developing. These problems are not a big deal as long as the corn plant doesn't need water, nutrients or help standing up.

Herbicide injury can be increased in shallow planted corn. For example, injury from pendimethalin, 2, 4-D and dicamba can be increased from shallow planted corn. A combination of shallow planting and urea in contact with the seed can also provide some impressive symptoms.

One might think that shallow planting would speed emergence. It does for some seeds. Unfortunately, the environment is a lot more variable near the surface. Some seeds will be exposed to adverse conditions and probably be slower to germinate/emerge. They may sit there a long time if the spring turns dry. Corn planted at two inches will likely be more uniform in emergence than shallow planted corn. Late emerging corn functions like a weed since it is unable to compete well with the plants around it that emerged earlier. There is a pretty strong evidence poor stand and weeds reduce corn yields.

Some final thoughts

Planting is one of the most important steps in obtaining good corn yields. It takes time and seed costs were substantial the last time I checked. You only get one chance to do this right. Set your planter to plant at a depth of one and three quarters to two inches and check your setting in each field. If your planter gets a bit shallower, you will be ok for depth. If you get a bit deeper you will still be ok. When checking planting depth in very mellow soil, you might want to step on top of the row to firm the topsoil before you measure depth.

Why would someone working in integrated pest management care about a fundamental agronomic issue like planting depth? Symptoms of shallow planting are usually blamed on herbicide injury and carryover, insect damage, disease problems and poor seed. Secondly, when a cornfield is already afflicted with reduced yield potential due to shallow planting caused complications, managing pests becomes a lot less interesting and profitable.

Acknowledgment: Figure of corn seedling from the National Corn Handbook, NCH-3, 1984. Cooperative Extension Service, Purdue University.

Preplant Manure Application For Soybean

Tim Wagar
Area Extension Educator
On behalf of the Southeast Minnesota Soybean Grower Education Program

Farmers who have used or would like to use manure to grow soybeans have questions about rates, yield response, and possible adverse affects on the crop. There can be positive and negative effects for soybeans. The primary advantage is that it provides greater flexibility for producers. All the manure in storage doesn't have to be applied before corn planting. It gives farmers additional acres for distributing manure to spread out environmental risks. A secondary benefit is that soybean efficiently utilizes nutrients in manure and there could be a yield response when higher rates are used.

A major disadvantage of using manure on soybean is the potential for increased weed pressure. Also, excess rates of manure could cause lodging, predispose the soybean plant to disease, and cause salt damage to seedlings when planted over injection rows. If the practice was overused, it would lead to a build up of excess soil P, lower soil pH, and leaching of soil nitrates.

The key is to use moderate or agronomic rates of manure. Last year a demonstration/research program in southeast Minnesota characterized the above statement well. Five sites were established on farmer cooperator fields to demonstrate the effects of manure for soybean production and to extend the research information that has been developed by U of M Specialists. Results from two of the demonstration sites are shown below. Both sites dealt with liquid manure. At Lewiston, dilute dairy parlor manure with a low N content was used. Swine finishing manure with a high N content was used at the Kilkenny site.

Preplant Manure Application/continued

Lewiston Treatment	Yield bu/A	Nitrate1 ppm	Nitrate2 ppm	Lodging 1-5
Control-0 lb N/A	54.8	5.2	7.2	2.2
Urea-100 lb N/A	53.3	-	-	2.5
8000 gal/A (55 lb N/A)	55.0	-	-	2.4
16000 gal/A (110 lb N/A)	54.4	7.1	7.2	2.3
LSD (0.05)	NS			NS
CV	7.1			

Nitrate1 - mid August Nitrate2 - late August
Lodging: 1 - lowest 5 - highest

Kilkenny Treatment	Yield bu/A	Nitrate1 ppm	Nitrate2 ppm	Lodging 1-5
Control-0 lb N/A	50.8	2.9 a	3.3 a	1.8
Urea-150 lb N/A	52.3	16.8 b	8.1 b	1.9
4000 gal/A (163 lb N/A)	49.2	17.7 b	10.9 b	2.2
8000 gal/A (326 lb N/A)	49.7	34.7 c	17.2 c	2.0
LSD (0.05)	NS	7.8	4.0	NS
CV	10.2			

Nitrate1 - mid August Nitrate2 - late August
Lodging: 1 is lowest and 5 is highest

Plot results from the on-farm demonstrations focused on soybean yield and residual soil nitrate. Manure rates had no effect on soybean yield or lodging at either site. Also there was no difference in yield and lodging at 4 out of 5 of the manure/soybean demonstration sites.

Prior to maturity of the soybean, one foot soil nitrate samples were taken from mid to late August to show the effect of soybean using the soil N contributed by the manure. Soybean plants normally produce their own N, but will prefer to take up soil nitrate if readily available. At the Lewiston site, the low N content of the dairy parlor manure resulted in soil nitrate tests that were similar to the preplant level of 4 ppm. Although up to 16,000 gals/A were applied, a relatively small amount of soil nitrate remained.

The manure used at the Kilkenny site had a much higher N content, which was evident in the significantly higher levels of residual soil nitrate that was present prior to maturity of the soybean. Soil nitrate levels varied by the amount of N in the manure and the rate applied. Based on this information, four thousand gal/A would have been adequate for this site.

This one year of demonstration/research results showed that when moderate or agronomic rates of preplant manure were used for soybean, there was no adverse effect to the plant and no excess accumulation of residual soil nitrates.

The "ACA" Story

George Rehm
Extension Soil Scientist

Recently, there have been several questions about the various trials conducted by the University of Minnesota to evaluate the fertilizer additive, ACA. In recent years, trials have been conducted in the field as well as in the growth chamber and greenhouse.

The field trials were conducted during the 1997 growing season. Two locations were used. The site in Olmsted County was in the field of a cooperating farmer. At Staples, the trial was conducted at the Irrigation Center. At both sites, the addition of either ACA+ or Awaken to the University of Minnesota fertilizer recommendations was compared to the control (University of Minnesota recommendations). The corn yields from these two sites are summarized in the following table.

Product Treatment	Rate	Olmsted County	Staples
		bu./acre	
U of M Recommendations	-	178 a*	173 a
U of M Recommendations & ACA +	20 oz./acre	175 a	165 a
U of M Recommendations & Awaken	2 qt./acre	180 a	168 a

** Yields at each site followed by the same letter are not significantly different at the .05 confidence level.*

In these trials, the addition of both ACA+ and Awaken to the University of Minnesota fertilizer recommendation had no positive effect on yield. The rates used were suggested by those who sold the products. These results are consistent with results of various other trials conducted throughout the North-Central states in which the use of ACA failed to increase crop yield.

The research carried out in the growth chamber and greenhouse was completed in an effort to identify or explain the physiological mechanism by which ACA might affect crop growth. In these trials, ACA was used at three concentrations for three corn hybrids.

The results were mixed. In our trial, the length of seminal roots of two of the three hybrids measured after three days of growth was increased by ACA use. The seminal roots are the first roots to emerge from the germinating seed. There was, however, no consistent effect on the total root length or dry weight of young corn seedlings which were ten days old.

Grain yield was not measured in these growth chamber and greenhouse trials.

Frequently, results of research projects conducted in the growth chamber and greenhouse cannot be repeated when the research is conducted in the field. Therefore, these mixed results from non-field situations must be viewed with extreme caution. An increase in the length of seminal roots of corn plants which are only three days old does not mean that there will be an increase in corn yield. A firm relationship between growth of seminal roots in solution culture and crop yield in the field has not been established in any research project.

The recommendations of the University of Minnesota with respect to the use of ACA, ACA+, and Awaken have not changed. Based on the results of field trials, there is no economic justification for the addition of these products to a fertilizer program and their use is not recommended at this time.

A Zinc Review

George Rehm
Extension Soil Scientist

Zinc (Zn) is a micronutrient essential for plant growth. Although essential, many soils in Minnesota are capable of supplying adequate amounts for crop production. The soil test for zinc is an accurate predictor of the need for this nutrient in a fertilizer program. Minnesota research has shown that the use of zinc in a fertilizer program, when needed, will produce substantial yield increases in the production of field corn, sweet corn, and edible beans. Addition of this micronutrient to fertilizer programs for other crops has not increased yields. Recommendations for rates of zinc needed are listed in the following table.

Zinc recommendation for corn, sweet corn, and edible bean production.

Zinc Soil Test	Zinc to Apply Band	or	Broadcast
- ppm -	---------- lb./acre ----------		
0.0 to 0.25	2		10
0.26 to 0.50	2		10
0.51 to 0.75	1		5
0.76 to 1.00	0		0
1.01+	0		0

These recommendations illustrate the effectiveness of the banded application of this micronutrient. The effectiveness of zinc fertilizer applied in a band is documented by research trials conducted in Nebraska (see the following table). The zinc soil test at both sites was low to very low.

The effect of rate of zinc applied in a band on the yield of corn grown on irrigated sandy soil having contrasting pH values.

Zn Applied	Site pH less than 7.0	more than 7.0
lb./acre	------- bu./acre ------	
0	152*	82**
.1	—	119
.3	—	127
1.0	—	135
1.5	170	—
3.0	165	132
6.0	168	—

* - one site ** - average of 3 sites

For the acid site, the use of 1.5 lb. Zn/acre in a band was adequate for optimum yield. Lower rates were not evaluated, but may have been equally effective. When the soil pH was higher than 7.0, yields increased as the rate of Zn applied increased to 1.0 lb/acre. Higher rates produced no additional yield. These results confirm the low recommendations for Zn when applied in a band.

There are various sources of zinc that can be used in a fertilizer plan. Some are liquid. Others are dry. Sources of Zinc were also evaluated in Nebraska studies. The results are summarized in the following table. The yields are averages for all rates of Zn applied for three years.

The effect of source of Zn on corn yield when grown on irrigated sandy soil with a pH higher than 7.0.

Zn Source	Yield bu./acre
Zn EDTA	142
Zn Ammonia complex	141
Zn sulfate	138

These results show that there is no difference among sources when the zinc is applied in a band at planting. Choice of a zinc source is dictated by the form of banded fertilizer used (liquid or dry) and the cost of the material. It's important to calculate the cost of a pound of zinc because the concentration of zinc in fertilizer products varies over a wide range.

Zinc can be an important component of a fertilizer program for some soils in Minnesota. Use a soil test to determine need, then calculate the cost of a pound of zinc before deciding on the source to use.

Glickman Extends Sign-up for Crop Loss Disaster Assistance Program to April 9

Wayne Bagget (202) 720-2032 and Steve Thompson (202) 720-1648, USDA
(news release- March 3, 1999)

WASHINGTON, March 8, 1999. Agriculture Secretary Dan Glickman today announced the extension of the sign-up deadline for assistance provided by the 1999 Budget Bill under the new Crop Loss Disaster Assistance Program. The new deadline is April 9, 1999. The sign-up was originally scheduled to end March 12th.

"This money is badly needed by farmers who suffered losses due to natural disasters, the effects of which are made worse by the current slum in farm prices, said Glickman. "We want to make sure that everyone who's eligible has a chance to participate."

More than $2 billion has been authorized by the Congress to reimburse farmers hit by natural disasters and who suffered losses greater than 35 percent of their historic yields.

Farmers are eligible for compensation either for qualifying losses on 1998 crops, or losses in any three or more crop years between 1994 and 1998 where crop insurance indemnity or assistance under the non-insured crop disaster assistance program was received. Farmers can receive payments under either single-year or multi-year provisions, but not both. The U.S. Department of Agriculture will make payment to each eligible applicant at the higher of the two levels.

Payments to farmers will be prorated after all applications are reviewed in order to stay within the program's budget requirements.

Farmers can contact their local USDA Service Center of Farm Service Agency local office, usually listed in telephone directories under "U S Government, Department of Agriculture." Crop loss payments will be made after all applications have been processed.

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MINNESOTA

CROP NEWS

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

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Row Spacing and Soybean Production

George Rehm
Extension Soil Scientist

The affect of row spacing on yield is always a popular topic of discussion for soybean producers. Some research projects have shown that narrow rows are better. Other studies have concluded that higher yields are associated with 30-inch rows. The results seem to vary with such factors as soil texture, tillage system used, variety, and weather conditions during the growing season.

Two row spacings (7 in., 30 in.) were evaluated as part of a recent study with the corn/soybean rotation at the West Central Experiment Station. Soybeans were grown in either a fall chisel or a no-till planting system in 1995 and 1997. The affect of row spacing on yield is summarized in the following table.

The affect of row spacing on yield of soybeans grown in two contrasting tillage systems.

Tillage System	Year and Row Spacing (in.)			
	1995		1997	
	7	30	7	30
	bu/acre			
fall chisel	42.9	37.3	41.1	40.5
no-till	50.1	35.3	39.1	36.4

The affect of row spacing was not consistent for both years. Yields were excellent in 1995 and there was a substantial difference between 7-inch and 30-inch rows with the narrow rows having the advantage. The difference between the two row spacings was small in 1997. At this time, there is no apparent explanation for the lack of consistent affects in the two years of production.

These results support the general observation that we cannot expect one-row spacing to be superior in all production situations in Minnesota. There are obviously other factors to be considered in the selection of soybean row spacing. For example, cultivation is a recommended management practice for fields where iron chlorosis is a problem. Narrow row spacings are obviously not a choice in these production situations.

Row spacings can affect soybean yields. However, don't expect one spacing to be superior for all fields or all production situations.

In this issue

Phosphate Management For Soybeans

George Rehm
Extension Soil Scientist

With the current commodity prices, crop producers are looking for ways to trim costs. There are several opportunities to trim production costs for various crop enterprises. However, there is also the temptation to eliminate the use of fertilizer for some crops. Most producers recognize the importance of nitrogen fertilizers and have seen the obvious yield increases which result from the application of nitrogen. There is a concern that the use of phosphate for some crops (soybeans for example) may be eliminated. This could be a financial mistake if soil tests for phosphorus are in the low or very low range.

In recent years, phosphate fertilizer has been applied in the fall before the next soybean crop at the West Central Experiment Station. The phosphorus soil test at the site was very low before the study was started (3 ppm by the Olsen procedure). Soybeans were grown in 1995 and 1997 and the yield increases were substantial (see the following table). The yields shown are averages for the subsurface band and broadcast application.

The affect of rate of applied phosphate on soybean yield at the West Central Experiment Station.

P_2O_5 Rate	Yield 1995	1997
lb/acre	bu/acre	
0	29.9	23.0
23	37.3	37.1
46	35.7	33.5
69	40.0	40.7
92	43.1	39.9

The economic return to the use of the phosphate fertilizer is shown in the table below. To calculate this return, the yields for the two years were totaled, the price of soybeans was set at $5.00 per bushel, and the cost of phosphate was set at $.25 per pound.

There is no logical explanation for the decrease in returns when the phosphate rate was increased from 23 to 46 lb. P_2O_5 per acre. This return is a reflection of the yields that were measured. The calculated returns to fertilizer use are for two soybean years.

These returns to phosphate application will, of course, change with the price of soybeans and the cost of the phosphate fertilizer. Nevertheless, there was a positive economic response to phosphate use when the soil test for phosphorus was very low.

Phosphate placement was also evaluated in this study. A deep band placement was compared to the broadcast application. The soybeans were planted over the deep band applied during the previous fall. The deep band was applied before the fall chisel operation which may have disturbed the band.

Soybean yields as affected by placement are listed in the following table. The yields were equal regardless of placement. Yields were slightly lower in the no-till planting system. The yields shown are for soybeans planted in 30-inch rows.

The affect of phosphate placement on yield of soybeans grown in two tillage systems.

Tillage System	Placement Subsurface Band	Broadcast
	bu/acre	
fall chisel	40.4	41.2
no-till	37.4	38.0

In thinking about fertilizing soybeans with phosphate, it is very important to take the soil test level of phosphorus into consideration. There is a relatively low probability of a yield increase if the phosphorus test is higher than **10** ppm (Bray procedure) or **8** ppm (Olsen procedure).

The return to use of phosphate for soybean production.

P_2O_5 Rate	Crop Value	Value of Yield Increase	Phosphate Cost	Added Value-Fertilizer Cost
lb./acre		$/acre		
0	264.50	—	—	—
23	372.00	107.50	11.50	96.00
46	346.00	81.50	23.00	58.50
69	403.50	139.00	34.50	104.50
92	415.00	150.50	46.00	104.50

Crop Loss Disaster Assistance Program

Kent Thiesse
Extension Educator

The Federal Government Budget for Fiscal Year 1999 included $2.375 billion for emergency financial as sistance to farmers that suffered crop losses due to natural disasters.

Following are details on the "Crop Loss Disaster Assistance Program":

1. Types Of Assistance Available:

* Farmers are eligible to receive compensation either for 1998 crop losses (single year) OR for multiple losses in any three or more crop years between 1994 and 1998 (multi-year).
  Farmers can receive payments under either the "single year" or "muti-year" provision, but not both.
* For Farm Operators that qualify for payments under both the "single year" and "multi-year" provisions, USDA will make payments at the higher of the two levels.
* This Program includes help for Farmers that had land flooded for an extended period of time and for Small Grain Producers that incurred multiple outbreaks of "SCAB".
* USDA will use an estimated $400 million for incentive payments to all Farm Operators to encourage the purchase of higher coverage levels of Crop Insurance for their 1999 crops. These incentives will show up as reduced rates for certain Crop Insurance coverage levels.

2. Eligible Crops:

The 1998 "single year" provision of this Program covers ALL CROPS as follows:

* Insured Crops—1998 crops insured by either CAT or "buy-up" Crop Insurance coverage.
* Uninsured Crops—998 crops for which Crop Insurance was available, but not purchased.
* Non-Insurable Crops—1998 crops for which Crop Insurance was not available.

The 'multi-year" provision covers "INSURED" and "NON-INSURED" crops, but does not cover "UNINSURED" crops.

3. Flooded Land:

USDA will make payment to Farm Operators that have crop land that is flooded and expected to be out of production indefinitely, and is not eligible for "Prevented Planted" Crop Insurance coverage.

4. Payment Calculation:

Farm Operators applying under the "single year" provision (1998 crop year),will be compensated if their 1998 crop loss exceeded 35% of their historic yields. Following are the payment formulas that will be used:

* Farmers with eligible losses on "INSURED" crops will be compensated at 65 percent of the Crop Insurance price election for the 1998 crop year.
* Farmers with eligible losses on UNINSURED" crops will be compensated at 60 percent of the Crop Insurance market price election for the 1998 crop year and must agree to purchase Crop Insurance for the 1999 and 2000 crop years.
* Farmers with eligible losses on "NON-INSURABLE" crops will be compensated at 65 percent of the five year average National Agriculture Statistics Service (NASS) price.
  The "Non-Insured Crop Disaster Assistance Program" (NAP) area loss triggers will not apply for this Crop Loss Disaster Assistance Program.
* Historic crop yields will be based on the greater of proven Crop Insurance yields, the five year NASS County average yield, or the NAP expected yield.
  Farm Operators applying under the "multi-year" provision will be compensated in the following manner:
* Farmers with eligible losses on "INSURED" crops will provide a payment equal to 25 percent of the Crop Insurance claim payments made in three or more years from 1994 to 1998.
* Farmers with eligible losses on "NON-INSURABLE" crops will be compensated at a rate of 25 percent of the NAP payments that they received or were eligible to receive in at least three years from 1994 to 1998.

5. Adjustments And Limits To Benefits:

No Farm Operator can receive more than $80,000 under this Program or $80,000 as a Crop Insurance incentive. Farm Operators with an annual gross income of $2.5 million or more are not eligible for this Program.

USDA reserves the right to prorate payments to Farmers after all applications have been received to stay within requirements and budget guidelines of the Program.

6. Program Enrollment Dates:

The Sign-up period for the Program is February 1 through March 12, 1999, at County Farm Service Agency Offices. Farm Operators may want to wait until after February 12 to apply at FSA Offices, since the sign-up period for the "Small Hog Operation Payment" (SHOP) Program is February 1 - 12, 1999.

7. For More Information:

To receive more information on the "Crop Loss Disaster Assistance Program", Farm Operators should contact their County Farm service Agency Office.

Choosing Relative Maturity for Corn

Zachary Fore
Cropping Systems Specialist

I don't suppose I would be the first person to have noticed that the weather varies from year to year in Minnesota. Some years are hotter than other years. Some years the frost comes earlier than other years. This variable weather becomes a practical problem when it comes to selecting what relative maturity of corn hybrid to grow. The goal is to select a hybrid that maximizes the use of the growing season without getting frozen before maturity. Fortunately, weather data has been collected in many areas throughout the state for many years. By using this weather data we can select hybrids that have a minimal chance of being frozen before they mature.

The weather data that is important when selecting relative maturity are: growing degree day accumulation (GDD) and frost dates. Here is an example of how to use this data to help select the relative maturity of a corn hybrid for Crookston.

The average GDD accumulation in Crookston over a 108-year period is 2442, as shown in Table 1 (using the standard growing degree-day formula for corn, with a 50°F base and an 86°F ceiling). However, some of these GDD's occur before planting, and some occur after a killing frost is likely. Let's assume that I want to grow a corn hybrid that will reach physiological maturity (PM) even if it is planted on May 15. That means that I can't use any GDD's that accumulate before May 15 (7 for March, 100 for April, and 117 for May).

Table 1. Corn Growing Degree Days (GDD's) and Adjustments for Crookston Minnesota.

Adjustment	GDD's
Total GDD's (108 yr.)	2442
March	-7
April	-100
May (-40%)	-117
September (-40%). 10% Chance of First Frost (30 F) by Sept. 15	-126
October	-131
November	-9
Total	**1952**

Let's also assume that I want a 90% chance of that hybrid reaching physiological maturity (PM) before a 30°F frost event. This means the hybrid must reach PM before Sept. 15 (Table 2). Therefore, I can't use the GDD's that accumulate after Sept. 15 (126 for the last half of September, 131 for October, and 9 for November). I have estimated that 40% of May's GDD's accumulate by the 15th of May, and that 40% of September's GDD's accumulate after the 15th of September. After making the necessary GDD adjustments, there are 1952 GDD's remaining. There are approximately 24 GDD per relative maturity day. 1952 GDD's divided by 24 results in 81 relative maturity days. A hybrid that matures in 81 days or less will have a very high likelihood of reaching PM in Crookston when planted by May 15.

Table 2. Fall Temperature Summary For Crookston, MN B 108 Years of Data

Event	32°F	30°F	28°F
Average First Date	9-22	9-25	10-1
Earliest	8-14	9-9	9-10
Latest	10-13	11-2	11-3
10% Chance By	9-10	9-15	9-19
90% Chance By	10-5	10-11	10-16

However, there is a 10% chance that a 30°F temperature event will occur before September 15 and the average GDD accumulation between May 15 and September 15 is 1952. In any given year, more or less GDD's may accumulate. Planting a hybrid with a RM of 81 or less does not guarantee any frost until the hybrid reaches PM. This only gives us good odds it will reach PM. What if GDD accumulation is less than average, and/or there is an unusually early fall frost? The yield affects of frost before PM are given in Table 3.

Table 3 shows that even if frost occurs 10 to 15 days before PM due to an unusually early fall frost or a lower than average GDD accumulation for the year, expected yield would be 90 to 95% of max yield. Therefore, there is minimal risk of significant yield loss when planting a hybrid that matures in 81 days or less in Crookston.

Table 3. Relationship Between Kernel Growth Stage and Development.

Stage	Calendar Days to maturity (average)	Growing Degree Days (GDD) to maturity	% of Max Yield		Moist. Content %	
			Grain	Whole Plant	Grain	Whole Plant
Silk	50-55	1100-1200	0	50-55	-	80-85
Blister	40-45	875-975	0-10	55-60	85-95	80-85
Late milkdough	30-35	650-750	30-50	65-75	60-80	75-80
Early dent	20-25	425-525	60-75	75-85	50-55	70-75
Fully dented*	10-15	200-300	90-95	95-100	35-40	65-70
Phys. mat.**	0	0	100	100	25-35	55-65

**Kernel milk-line moved 1/2 to 3/4 the distance between crown and base.*
***Black layer formation and/or milk disappearance from kernel under normal development. Premature frost or extended cold temperatures may cause black layer formation at earlier stages and wetter moisture.*

Soybean Seed Inoculation

Dave Schwartz
Extension Educator—Soybeans

Soybean growers are asking more questions this winter about the value of inoculating soybean seed. How is it done? Is it necessary? What kind of yield response can I expect? Seed inoculation was a common practice when soybeans first caught on as a cash crop in the state. Some of you may remember helping Dad mix the black peat material with seed in the planter box. Seed was inoculated with Rhizobia bacteria to promote nitrogen fixation for optimum growth and development. Once fields were planted with inoculated seed, it was believed the bacteria could survive in the soil so this seed inoculation practice would not be necessary again in the future unless soybeans had not been planted in a crop rotation for several years. Soybean inoculant may contain a single or multiple strains of Rhizobia. Rhizobia are packaged in a number of different types of carriers-compost, talc, peat, agar slants, bagasse, and liquid (even frozen).

Some of the new products on the market are characterized as sterile inoculants, meaning the carrier is sterilized using gamma radiation before adding Rhizobia. Sterile inoculants probably outperform the traditional inoculants because they simply have much higher bacteria counts, e.g. 200 million bacteria per gram with traditional peat moss inoculant versus one to two billion bacteria per gram with the sterile inoculants. They also have a longer shelf life. The traditional peat based inoculants are selling for approximately 65 cents per bushel of seed where the sterile inoculants are nearly double or $1.20 per bushel of seed. If seed is treated with a fungicide, the inoculant may need to be applied separately in the furrow at planting time because many of the fungicides are toxic to inoculants (read label for seed treatment compatibility). Also, inoculated seed should be planted the same day it is treated or bacteria populations are reduced.

Soybean seed inoculation recommendations vary somewhat by state. University of Wisconsin Agronomist Ed Oplinger recommends seed inoculation every year. In addition, first time fields should be inoculated at twice the recommended rate to make certain adequate nodulation occurs. Dr. Oplinger feels inoculation is cost affective in Wisconsin because soils are cool (and often no-tilled), sandy, and fields have a longer crop rotation history. In 16 tests, the average yield increase was 2.0 bushels/acre when the labeled rate was applied compared to the control.

University of Minnesota research shows little yield advantage to inoculants in corn-soybean rotations. Dr. Dale Hicks from the Agronomy Department in St. Paul had inoculation trials at four Experiment Stations during the 1998 growing season-Crookston, Morris, Lamberton, and Waseca. Although inoculants were not shown to significantly affect yields, in most treatments there was a slight yield advantage—one to three bushels per acre—where seed was treated with an inoculant. Our recommendation, therefore, is that seed inoculation is recommended when soybeans have been out of a crop rotation more than four years and where soybeans will be planted in land being released from the Conservation Reserve 10 year Program. The University of Minnesota has a great website for those interested in more detailed information on Rhizobia-www.rhizobium.umn.edu

Canola Annual Conference

Ervin Oelke
Extension Agronomist

The 1999 Canola Annual Conference organized by the Minnesota Canola Council in conjunction with University of Minnesota Extension Service and Agricultural Experiment Station will be held on March 4, 1999, at the Roseau Community School, 509 3rd Street N.E., Roseau, MN. Registration starts at 8:00 AM and the program at 9:00 AM and ending at about 4:00 PM. The Conference will be of interest to everyone involved or thinking about involvement in the canola industry. The program will provide the latest production and marketing information on this new high-value oilseed crop for northern Minnesota. During the last 2 to 3 years canola has been a good crop in the northern Minnesota area that has been devastated by severe scab (head blight) in small grains. In 1998 there were about 200,000 acres planted in Minnesota and about 700,000 acres in North Dakota. The acreage in Canada was about 13 million in 1998.

Speakers from Minnesota, North Dakota, and Canada will be discussing results from their own and others' research. In addition, marketing information will be presented by individuals from the processing and marketing industry. The attendees will also be brought up-to-date on the activities of the Minnesota Canola Production Centre and Pesticide Harmonization Program. Both of these programs were made possible by the generosity of the 1998 Minnesota Legislature.

The canola seed and chemical industry is changing rapidly with advances in seed and herbicide technologies. Many new open-pollinated and hybrids are being developed, some with specialty oils, herbicide tolerance and other characteristics. Producers will have many choices in choosing their production inputs. Crop prices to producers are low right now, thus producers will have to carefully plan

Canola Annual Conference/continued

inputs and marketing strategies to increase production efficiencies and profitability. This also means looking at the whole cropping system to obtain the maximum efficiency of the whole system. Attending the Canola Annual Conference will help in making management decisions for the 1999 growing season.

Tentative Program

Time	Topic	Speaker(s)
8:00	Registration	
9:00	Pesticide Regulation and Harmonization	Beth Nelson
9:30	Canola Production Centre Trials	Derwyn Hammond, Dave LeGare
10:15	Varieties and Date of Planting	Ervin Oelke
10:45	Weed Control/Herbicide Resistance	Brian Jenks
11:15	Break/Exhibits	----
12:00	Canola in the Cropping System	Zachary Fore
12:30	Canola Insect Management	Ian MacRae, Denise Olson
1:15	Lunch	----
2:15	Humer, Heritage, and Pride	Jerry O'Connor
2:45	Canola Disease Management	Art Lamey, Dick Meronuck
3:15	LDPs as a Crop Management Tool	Karen Fredrickson
3:45	Marketing Opportunities—Panel Discussion	James Loeron, Al Dombeck, Bruce Love

For more information and registration material contact:
Minnesota Canola Council, Tele: 651-638-9883; Fax 651-638-0756;
email: mncanola@aol.com

1999 Seed Germination Tests

Gary Wyatt
Extension Educator

Producers who plant bin run soybeans should test their lot for germination. The Minnesota Department of Agriculture still conducts seed germination tests for minimal fees.

1. Germination Only—Four 100 seed replicates are tested for 5 to 7 days under fluctuating temperatures (68 to 86°F). The average germination percent of the four replicates is the final percent. The cost is $7.50 per sample.
2. Vigor or Accelerated Aging Test (AA Test)—The seed is stress tested under moisture and heat conditions for 72 hours then planted and grown for 5 to 7 days. (Vigor test = $10.00 plus the germination test $7.50 = $17.50 per sample.)

Contact the Extension Office for seed envelopes. For more information, call the MDA Lab at (612) 296-4749 or (612) 296-2310.

Spring Handling of Wet Corn and Beans

Bill Wilcke
Extension Engineer

For a variety of reasons, a number of farmers have shelled corn or soybeans in their bins that are too wet for safe storage into spring and summer. What moisture levels are safe for storage? Crop storability is a function of both temperature and moisture. The colder the storage temperature, the higher a crop's moisture can be before molds and insects cause quality loss. During winter, if stored crops are cooled to less than 30°F, they can be held at fairly high moisture levels with minimal risk of storage. During spring and summer, we lose the ability to keep crops below 30°F (unless we choose to spend money on refrigeration) and we need to reduce moisture content to avoid spoilage. Corn should be dried to 14 to 15% moisture for storage into spring, 14% for storage into summer, and 13% for longer-term storage. Soybeans should be 12 to 13% moisture for storage into spring, 12% for storage into summer, and 11% for longer-term storage.

If stored corn or soybeans are wetter than the values just listed, and the storage bin is only equipped with a duct-type aeration system and a small fan that delivers less than 0.5 cfm/bu (cubic feet of air per minute per bushel of grain in the bin), the crop will probably mold this spring or summer. Crops should be sold, fed, or moved out of the bin and dried to a safe moisture level before the weather gets too warm.

Using gas-fired dryers in late winter or early spring is an option for both corn and soybeans. After drying, the crop should be cooled to less than 50°F for summer storage, so make sure you complete drying before average outdoor temperatures get above 50°F. Expect energy costs for gas fired drying to be about $0.01 per bushel per percent point of moisture removed and total drying costs (energy plus labor, depreciation, repairs, etc.) to be $0.02 to 0.03 per bu per point. Labor, equipment, and transportation costs for moving crops to the dryer and back to storage will add a few more cents per bushel. Soybeans can also be dried in ga[redacted]dryers, but soybeans will [redacted] dried too fast or at too high a temperature, so use a much lower drying temperature than you would with corn. If any of the soybeans will be used for seed, keep drying temperature under about 110°F to avoid killing the seed embryo.

If you have a bin available that has a full perforated drying floor and a drying fan that can deliver about 1 cfm/bu, natural-air drying can be another option for slightly wet beans and corn. University of Minnesota Extension Service bulletin, *Natural-Air Corn Drying in the Upper Midwest*, BU-6577, gives a good overview of natural-air drying and provides suggestions for spring drying. You need to start spring drying early because if you wait too long, the weather will get too warm and the crop at the top of the bin will mold before it dries and the crop at the bottom of the bin will get drier than it needs to be. The wetter the crop is, the earlier you need to start. For corn wetter than 19% moisture, start watching the weather about March 15, and as soon as it stops snowing and average outdoor temperatures stay above freezing, turn on the drying fan and let it run until the drying front moves through the top of the bin. For 17 to 19% moisture corn, start drying around April 1, and for 15 to 17% corn, start drying around April 15. For soybeans, use the same dates, but reduce moisture values by abou[redacted]centage points. In other [redacted], for soybeans wetter than 17%, start drying about March 15.

For more information on soybean drying, see the drying, handling, and storage chapter in the new University of Minnesota Extension Service *Minnesota Soybean Field Book*, MI-7290. Contact an Extension office for additional information on managing crop drying and storage.

Plant Disease Clinic

Sandra Gould
Plant Disease Clinic

Samples that were submitted to the Plant Disease Clinic for analysis recently included:
corn—cultured for storage molds
wheat—cultured for storage molds
barley—tested for loose smut
turnip—Alternaria sp and Rhizoctonia sp(storage decay)
hibiscus—Phytophthora sp stem and root rot
geranium—Xanthomonas campestris pv pelargonii (bacterial wilt)
E. lily—Rhizoctonia sp stem rot, also to Entomology for bulb mites
scabiosa—Impatiens necrotic spot virus (INSV)
spikes—INSV
chrysanthemum—INSV
mandevilla—Cercospora sp leaf spot
Other hosts that tested negative for INSV and TSWV included ajuga, campanula, phlox, Aruncus, impatiens, Achillea, sage, lavender, Heuchera, lobelia, sedum, vinca, aster, begonia, fuchsia, lemon verbena, tarragon and rosemary

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