What's Cropping Up?

A NEWSLETTER FOR NEW YORK FIELD CROPS & SOILS VOLUME 5, NUMBER 1, 1994

Protecting Your Germinating Corn Stands from Seed Corn Maggot and Wireworms

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Department of Entomology

With the continuing emphasis on maximizing corn yield, the protection of germinating corn stands from seed corn maggot and wireworm losses becomes increasingly important. Current NY research by Bill Cox has shown that final plant populations at harvest should be between 26,000 and 32,000 plants per acre to maximize corn yields with current corn hybrids. However, these two insect pests typically reduce corn stands by 3,000-8,000 plants per acre and on occasion reduce corn stands below 15,000 plants per acre.

Seed Corn Maggot Biology:

Adult seed corn maggots are medium sized flies, very similar in appearance to the common house fly. Adult flies are present throughout the growing season and locate egg laying sites by alternately flying close to the ground's surface or searching the moist soil cracks on the soil surface. The adult female flies are searching for egg laying sites close to decaying plant material or germinating seed to provide a food source for the newly hatched larvae. Adult flies lay eggs in these moist soil cracks near these potential food sources and typical looking fly larvae (maggots) hatch from the eggs within a few days. After hatching, larvae move through the soil searching for decaying plant matter or germinating seeds to feed on. Large seeded crops like corn or soybeans are very susceptible to seed corn maggot attack resulting in stand losses. Germinating corn seed are often killed or severely injured thereby reducing plant populations within an area of the field or throughout the entire field. Losses typically range from 3,000 to 8,000 plants per acre. Fields in which animal or green manure crops have been used have a greater potential for seed corn maggot attack than fields not using these manures. However, non-manured fields are also "at risk" from seed corn maggot damage.

Wireworm Biology:

Wireworm larvae are long, smooth, very hard bodied, yellowish to reddish brown and commonly occur in grass sods feeding on roots of numerous grass plants. This insect becomes an economic problem when these grass sods are plowed up and planted to a large seeded crop like corn. Wireworms are the larvae of the common "click beetles" which are attracted to lights during the warm summer months. Several different species of wireworms can be economic pests with 2-7 year lifecycles (egg to adult). Wireworm populations are difficult to assess and usually occur in low to moderate levels. Stand losses from wireworm feeding typically range from 2,000 to 5,000 plants per acre.

Management of Seed Corn Maggot and Wireworms:

Both of these insects are easily and inexpensively controlled with the regular use of insecticide added to the planter box as a seed treatment. **Seed corn is seldom pretreated with insecticide effective for control of these two insects.** Seed corn is treated with insecticide to protect the seed corn from insects while the corn seed is in storage. Any commercial seed treatment containing the insecticides diazinon and lindane are effective for control of these two insects. Examples of two such products are Agrox DL Plus™ and Germate Plus™. Seed treater is typically packaged in small packets which contain the correct amount of material to treat 1 bag of seed corn. For maximum effectiveness, corn seed needs to be evenly coated with the seed treatment. If a plate type or plateless planter is being used, pour 1/2 bag of seed corn into the seed hopper then sprinkle 1/2 of the seed treatment packet on the surface of the seed corn and mix thoroughly with a wood stick. Pour in the remainder of the seed corn into the hopper, sprinkle the remainder of the seed treatment on the surface of the seed and repeat mixing. In air planters, seed corn and seed treater **must be mixed in a bucket before dumping seed into the seed drum.** If seed corn and seed treater are dumped separately into the seed drum, the drum action will not adequately coat the seed with seed treater and protect the seed from seed corn maggot and wireworm injury.

SOIL FERTILITY

Fine Tune Your Fertilizer Program for Corn

Stu Klausner
Soil, Crop and Atmospheric Sciences

Background

Corn is an important grain and forage crop for the livestock and poultry industry. Nearly 1.1 million acres of corn are grown in New York and it represents about one-third of our field crop acreage. Because of its economic value, it pays to take good care of corn.

An important part of managing corn is to ensure an adequate supply of plant nutrients. Good soil fertility management means having the right amount of nutrients available when the plant needs it. The proper rate, timing and placement of fertilizer is essential for maximizing fertilizer efficiency, crop productivity, profit, and minimizing loss. Because corn has a high nutrient demand, it's important to know how much fertilizer to apply in order to supplement the nutrients already present in the soil. The best way to determine fertilizer requirements is to soil test on a regular basis. Soil testing is a must to help prevent under or over fertilization.

Research

The recommendations from a soil testing laboratory should be backed up with a research program to ensure that you are getting the best information for *your* climate and soil type. We run several fertilizer trials each year to calibrate the fertilizer recommendations with the soil test results. This helps to keep Cooperative Extension's recommendations on target. Several field trials were recently conducted to determine the most economical fertilizer rate for N, P and K on moderately well to well drained soils with medium soil test P (5-7 lbs/a) and K (64-70 lbs/a) levels. These soil test levels are fairly typical for cash grain farms but are much lower than normally found on dairy farms because manure was not used. The experiments were in their third to eighth year of corn.

Fertilizer N was applied as a split application where 30 lb/a was band placed in the starter fertilizer (except non-fertilized control), and the remainder sidedressed in mid-June. All of the P and 25-30 lb/a of K (except controls) were band placed in the starter fertilizer. The remainder of the K was applied preplant and disced in. Plenty of fertilizer, minus the nutrient being tested for, was added to each treatment to be sure other nutrients were not limiting (ex: P and K were applied to each N treatment). The treatments were replicated four times. Fertilizer rate, yield, and fertilizer cost are shown in Tables 1 and 2 for the three locations. The data for site 1 is an average of three yrs., site 2 for two yrs., and site 3 for three yrs. for P and K and one yr. for N.

As expected, the fertilizer rate had a large affect on yield. The lowest yield occurred when fertilizer was not used (rate 1 in Table 1) and reinforces the economic importance of applying fertilizer

Table 1. Average corn yield and fertilizer cost at 2 sites. 1989-91

Fertilizer rate, lbs/a $N-P_2O_5-K_2O$		Grain, bu/a Site 1	Grain, bu/a Site 2	Fertilizer cost/a
1.	0-0-0	85	78	0
Soil test recommendation				
2.	140-30-60	142	---	$51.00
	140-45-70	---	151	$56.00
N-response, lb/a N				
3.	0	90	69	0
4.	50	119	121	$12.50
5.	100	143	139	$25.00
6.	200	143	143	$50.00
P-response, lb/a P_2O_5				
7.	0	145	143	0
8.	30	141	148	$ 7.50
9.	90	143	143	$22.50
K-response, lb/a K_2O				
10.	0	131	137	0
11.	30	144	141	$ 4.20
12.	60	147	149	$ 8.40
13.	120	149	143	$16.80
14.	240	143	143	$33.60

Table 2. Average corn yield and fertilizer cost at site 3. 1992-94.

	Fertilizer rate, lbs/a N-P_2O_5-K_2O	Grain bu/a	Fertilizer cost/a
Soil test recommendation			
1.	140-40-55	167	$52.70
N-response, lb/a N			
2.	0	67	0
3.	30	96	$ 7.50
4.	60	127	$15.00
5.	120	166	$30.00
6.	180	174	$45.00
P-response, lb/a P_2O_5			
7.	0	150	0
8.	15	160	$ 3.75
9.	30	161	$ 7.50
10.	60	156	$15.00
K-response, lb/a K_2O			
11.	0	149	0
12.	25	159	$ 3.50
13.	50	157	$ 7.00
14.	75	162	$10.50
15.	100	159	$14.00

when needed. Fertilizer N increased yield dramatically (rates 3-6 in Tables 1, 2) up to an economic maximum of about 100, 120, and 140 lb/a at sites 1, 2, and 3, respectively. A high rate of N was needed at all locations because none was supplied by manure or crop residues (ex: plowing down alfalfa or grass for corn).

Applying fertilizer P didn't improve yield at the first 2 locations (rates 7-9 in Table 1), and only a small amount of P in the starter fertilizer was important for improving yield at site 3 (rates 7-10 in Table 2). The maximum economic fertilizer K rate at all locations varied between 25-60 lb/a. It is not unusual to have no or only a small yield response to fertilizer P and K at a medium soil test level. By definition, one should expect an economic yield response to the added nutrient about 50% of the time when the soil test is medium.

The last column in Tables 1 and 2 shows the annual fertilizer cost for each rate. Compare the yield and fertilizer cost for the soil test recommendation with that of any other combination of N, P and K. The recommendation resulted in excellent yields and was close to the economic optimum. The recommendation missed being the most economical rate of those tested because it slightly over estimated the need for N at one location and P at all locations. However, over the years the data demonstrates that recommendations based on field research provide the best estimate of economic response and improved nutrient cycling.

Don't assume that corn always requires 100-140 lb/a of fertilizer N and minimal amounts of P and K. The economic fertilizer rate will vary depending on the crop, soil type, soil test level, the amount of N applied in manure, crop residues, etc. For example, Table 3 shows the results of several more experiments where the fertilizer N requirement for the first year of corn following alfalfa was much lower, and the fertilizer K requirement much higher than in the first three experiments. Why? Because N supplied by the decomposing alfalfa reduced the need for additional N, and as expected, more fertilizer K was required on the very low soil test K site compared to the medium soil test sites discussed earlier. Soil testing coupled with research based recommendations is not a perfect science, but it sure can help improve nutrient management.

Conclusions

It is important that nutrient management recommendations be based on a strong research program that continually calibrates the recommendation made by the soil testing laboratory. Soil test on a regular basis to ensure profitability and reduce the potential for nutrient loss. Good nutrient management will not result in a loss of profit, but it does require a high level of management.

Table 3. Fertilizer N response for the first year of corn after alfalfa and fertilizer K response on a "very low" soil test K site.

N-response		K-response	
Fertilizer N lb/a	Grain bu/a	Fertilizer K_2O lb/a	Corn silage tons/a
20	161	0	4.9
60	158	40	16.4
120	156	80	19.9
180	157	160	21.5

SOIL FERTILITY

An Even Spread is a Better Spread

Peter Wright
Agriculture and Biological Engineering

To maximize the fertilizer value of manure you need to manage the manure like fertilizer. It should be spread evenly so the nutrient value you need is available throughout the field. More attention needs to be paid to how well our manure application systems work.

Technology has changed manure spreading. Larger tank spreaders, irrigation equipment and drag hoses are being used to make the spreading operation more efficient. Yet it remains as important as ever to manage the manure as fertilizer when it is being applied.

Fertilizer should be applied as near as possible to the time it will be used. It should be spread as evenly as possible to avoid excess which could be wasted and to prevent too little being applied so production suffers. The amount per acre required needs to be calculated and the fertilizer spreader needs to be checked to ensure that a known rate is being applied. These same principles must be followed when spreading manure as fertilizer.

Stu Klausner, soil fertility specialist, has put together an easy method to determine how much manure should be applied in his "Nutrient Management Workbook". Jim Capron, area field corps specialist, showed several methods of determining the rate applied per acre in his contribution to the "Liquid Manure Applications Systems Conference Proceedings". Even with these procedures if the manure is spread unevenly production will suffer if not enough is put on or fertilizer value will be wasted and the environment downstream may suffer needlessly with excess application.

Figure 1 shows the varying rates of nitrogen from the manure applied across the path of a traveling gun irrigation system. This system was pumping 7% solids for two miles. The 130 foot diameter pattern shows that the pressure was too low. A distribution pattern with these extreme variations is an inefficient use of fertilizer and will likely lead to excessive losses to the environment. When the system was used to irrigate manure on fields closer to the system, pressure increased and the pattern improved.

Providing the correct pressure is not the only concern in obtaining an even application. Figure 2 shows the distribution produced

See Spread, page 8

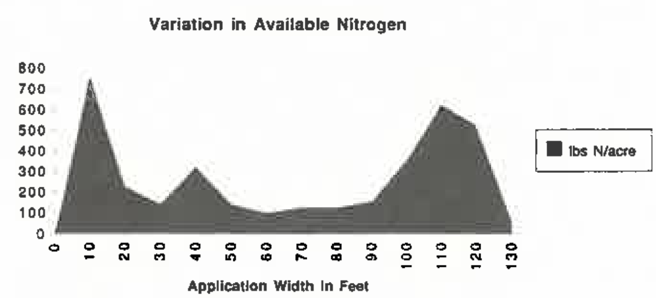

Figure 1 Distribution of available nitrogen from a traveling gun irrigation system under low pressure. The gun was located in the middle at the 65 foot point.

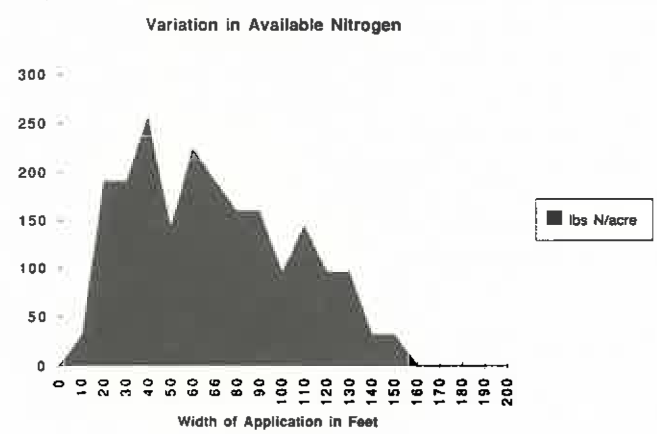

Figure 2 Distribution of available nitrogen from a traveling gun irrigation system with 15 mph wind from the right. The gun was located at the 95 foot point.

Predicting Alfalfa Forage Quality in the Spring

PEST MANAGEMENT

Jerry Cherney
Soil, Crop and Atmospheric Sciences

Timing of spring alfalfa harvest is critical to obtaining optimum forage quality for dairy cattle. A quality prediction method must be used to have reasonable accuracy. As milk production potential increases, the need for more control over forage quality increases.

What is Optimum Alfalfa Quality?

Actual composition of optimum quality alfalfa is dependent on its intended use, but total fiber content (NDF) of the forage is the primary forage quality variable of concern when attempting to predict forage quality. Acid detergent fiber (ADF) is commonly used as an important forage quality variable across the U.S., but its use as a predictor of forage quality is discouraged by Cornell Animal Scientists. Although crude protein is important, it is not an acceptable parameter to define optimum alfalfa quality. At optimum fiber levels, there may be too much crude protein in alfalfa. Also, crude protein gives no indication of the amount of soluble protein in a forage, which is critical for evaluating the nitrogen in a forage crop.

Optimum alfalfa forage NDF for high producing dairy cows is considered to near 40% for hay and near 45% for silage. Alfalfa forage much below the optimum level can be more of a problem than high fiber forage. With these quality goals in mind, what can be done to assist an alfalfa producer in timing their harvest management?

Prediction Methods

Chronological age, growing degree days (GDD), and plant morphology have all been related to forage quality, however, prediction equations based on these parameters have almost always been found to be inaccurate when tested in a different environment. Three years of alfalfa sampling at several New York locations have lead to the relationship between NDF and GDD shown in the Figure. While there may be a very close relationship between NDF and GDD at a particular site in a given year, it is not consistent from site to site and year to year. Growing degree days was a better predictor of NDF than chronological age, plant stage, or plant height. When the GDD equation is tested with other data, however, prediction of alfalfa quality based on GDD may be quite good at some sites, and unacceptable at other sites.

Prediction based on Analysis

Because the number of GDD per unit change in NDF is relatively consistent, it is possible to use a combination of alfalfa analysis in early May and GDD to predict a date for 40% NDF. If alfalfa is sampled in early May and analyzed for NDF, historic weather data can be used to determine how many days it will be from the date of field sampling to the date of 40% NDF. Applying this method to data from three sites in 1991, the predicted date of 40% NDF was within 2 days of the actual date. More testing is needed to determine the robustness of the method, but it looks promising.

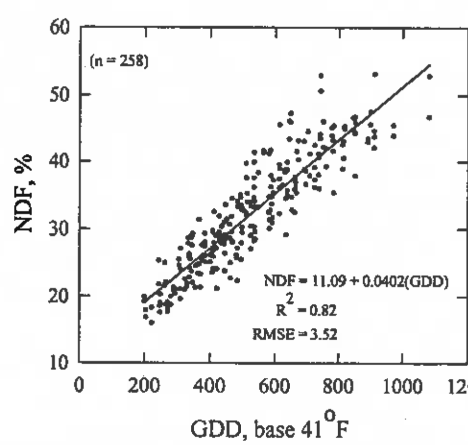

Figure 1. Prediction equation for NDF using growing degree days and 1992-94 New York data.

Summary

Alfalfa forage quality prediction should be based on the optimum forage NDF content, which is related to storage form and intended use of the forage. Prediction of harvest date based solely on equations will likely not be acceptable under all environmental conditions. The combination of forage analysis early in the season followed by prediction using GDD will improve the accuracy of harvest date forecasting. The actual date that harvesting is initiated is dependent on the expected duration of first harvest. Anticipated field harvest losses in quality, as well as storage losses in quality also can be factored in when estimating the start date for spring harvest.

FORAGE QUALITY

Management of Corn Rootworm for the 1995 Growing Season

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Western corn rootworm and lodged corn resulting from larval feeding damage has become a common topic of discussion throughout the New York dairy and cash grain production regions. While this insect was not a pest that New York state corn producers had to manage prior to the 1980's, the management of this insect on New York corn will be a topic of discussion for years to come.

Life Cycle and Damage

Adult corn rootworm beetles (CRW) are found in corn fields from pollination until the first killing frost (late July - Oct.). During this time, the adult females are laying eggs in the soil cracks and around the bases of corn plants which will overwinter and hatch in late May (next spring). In the spring, newly hatched larvae locate the young corn plants and begin feeding on the developing roots. Larval development and root feeding damage are completed by mid July, larvae pupate and emerge as adult beetles during late July and early August to begin laying eggs to complete their life cycle.

CRW larvae damage corn by feeding on the root system and if present in sufficient numbers, will reduce corn yields by inhibiting the ability of the corn plant to uptake water and nutrients. Additional yield loss occurs as CRW larval feeding destroys the plant's brace roots resulting in harvest loss due to lodging. Harvest losses due to lodging are usually of greater importance than physiological yield losses. Potentially damaging populations of CRW are controlled by rotation to a non-susceptible crop or by soil insecticides incorporated in the seed bed at planting or at cultivation.

Fields at Risk in 1995

Fields planted to continuous corn are at greater risk to economic CRW infestations than first year corn since CRW eggs are laid the previous fall in existing corn fields. Fields in continuous corn production increase the risk of developing economic CRW infestations, the longer corn is planted to the field on a continuing basis. Continuous corn fields planted after late planted corn the previous year are at high risk due to the attractiveness of the late pollinating corn to the adult CRW resulting in heavier than normal egg laying in the field.

Research conducted during the 1991-92 growing seasons by Dr. Paula Davis indicates that corn grown for silage is much more sensitive to yield losses from CRW feeding than corn grown for grain. In corn grown for silage, as few as 100 CRW eggs/row foot (root damage rating of 2.9) results in economic losses from $13-$18 per acre. Economic loss in silage corn frequently occurs without lodging or "goose-necking" as an indication of larval feeding. In contrast, corn grown for grain suffers losses between $3-$5 with 100 CRW eggs/row foot. With the cost of soil insecticides ranging between $14-$18 per acre, an insecticide is warranted in fields grown for silage with as few as 100 CRW eggs per row foot. However, in fields of corn grown for grain, soil insecticide is not economically warranted until the egg population rises to a minimum of 300/row foot (root damage rating of 4.0).

The need to rotate or use a soil insecticide at planting for control of CRW can be determined by counting the number of adult CRW beetles per 55 corn plants (5 plants in 11 different field locations within a field) in each corn field during and shortly after pollination. If these beetle counts exceed 1 beetle per plant as a field average, then a registered soil insecticide is recommended at planting the following spring. Please refer to the "1995 Cornell Recommends for Integrated Field Crop Management" for the recommended soil insecticides for New York.

Efficacy of Currently Registered Soil Insecticides

Results from the 1994 CRW soil insecticide efficacy trial are listed in table 1. On the 1-6 Iowa root damage rating scale, damage ranged from 2.15 (very little damage) to 5.00 (severe damage) in the untreated checks. Economic losses begin to occur between 3.0 and 3.5 depending upon the frequency of rain during July and early August, the root regeneration capabilities of the corn variety and the usage (silage = more sensitive, grain = less sensitive). CRW larval pressure was heavy at both sites.

See Table 1 on page 7.

From Spread, page 4

from a different traveling gun irrigation system. Again measurements were taken perpendicular to the path of the gun. The pattern was shifted by a 15 mile per hour cross wind blowing from the right. Not only did this distort the intended application in the swath but it also left a 30 foot gap between the up wind adjacent swath. The variability of the wind made predicting the best placement of each setup difficult. After seeing the 30 foot gap left because of the wind the next setup was offset 30 feet. Then the wind ceased resulting in a double application over that 30 feet.

Irrigation is not the only spreading method that can result in a poor distribution of nutrients. Some tank spreaders and box spreaders have been shown to have poor distribution within the swath of manure application. They can also be affected by the wind. Daily spreading can add to the complication of determining where the manure was spread after snow has covered the previous days application. These non-uniform application rates cause producers to overapply fertilizer as an insurance against deficiencies. This leads to extra losses to the environment.

We all need to work to apply the manure as evenly as fertilizer should be. One way is to apply thinner multiple applications. These would average out the variations in the spreading. Avoiding windy conditions would eliminate the problem of wind distortion. Calibrating the spreader whether it is a tank spreader or an irrigation system is essential. Perhaps we'll see a global positioning system soon that determines the actual application rates for manure like the ones that are beginning to be used for pesticides and commercial fertilizer. For now the best advice is to determine the uniformity of your system and overlap lighter applications to get a more even spread.

Table 1. Efficacy of soil insecticides against corn rootworm larvae in New York. Trials were conducted at both Aurora, NY (PH > 8.0) and Tully, NY (PH = 6.7) during 1994.

Compound	Timing	Placement	Aurora	Tully
Counter 15G	AP	If	3.90*	3.20
Counter 15G	AP	T-Band	2.55	3.00
Counter 20CR	AP	IF	4.15	3.60
Counter 20CR	AP	T-Band	2.50	3.00
Dyfonate 20G	AP	T-band	2.75	3.00
Dyfonate 4E	AP	T-band	2.95	3.60
Force 1.5G	AP	IF	2.20	2.20
Force 1.5G	AP	Tband	2.15	2.80
Lorsban 15G	AP	Tband	3.90	2.80

Calendar of Events

June 8	Small Grain Management Field Day, Aurora Research Farm, Aurora, NY
June 25-28	Northeast Branch American Society of Agronomy Meetings, University of Maine
July 12	Cornell Seed Field Day, Ithaca, NY 9-12 noon
July 12	Cornell Weed Days, Aurora Research Farm, Aurora, NY 1-5 pm
July 13	Cornell Weed Days, Ithaca/Freeville, NY
Oct. 29-Nov. 3	American Society of Agronomy Meetings. St. Louis, MO

What's Cropping Up? is a bimonthly newsletter distributed by the Department of Soil, Crop and Atmospheric Sciences at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments at Cornell University: Soil, Crop and Atmospheric Sciences, Plant Breeding, Plant Pathology, and Entomology. **To subscribe, send a check for $8.00 along with the form at the right.**

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