What's Cropping Up?

A NEWSLETTER FOR NEW YORK FIELD CROPS & SOILS VOLUME 7, NUMBER 2, 1997

Use the Right Tool When Spreading Manure

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When spreading manure it is important to achieve a uniform application rate. If applied unevenly there may be runoff or leaching of nutrients in some areas and/or deficits for optimum plant growth in other areas.

Technology has changed manure spreading. Cost control is driving farmers to find the cheapest method for manure spreading possible. More liquid manure systems are being installed as farms are storing more manure outside so that it is diluted with rainfall. Larger tank spreaders, irrigation equipment and drag hoses are being used to make the spreading operation more efficient.

Many irrigation systems, tank spreaders, and box spreaders have been shown to have poor distribution within the swath they apply the manure. The poor distribution may be because of the mechanics of the system, or the effects of wind. Daily spreading can add the complication of determining where the previous days manure was spread. Different people, a poor memory, or snow conditions can confuse the application process.

Because of the concerns about the uniformity of manure application, 26 spreading systems on farms in New York State were evaluated. These systems included tanker spreaders, V-spreaders, traveling guns, a drag hose applicator, and center pivot systems. All of these systems are potential choices for manure spreading for the farmers in the state.

A coefficient of uniformity was determined for each system. The higher the coefficient the better the uniformity. Most water irrigation applications are considered acceptable when the coefficient of uniformity is 0.85 or better. Table 1 shows the uniformity coefficients for each system. The adjusted average was obtained by eliminating those coefficients of uniformity obtained when there was an obvious problem.

Only the best two tank spreaders compare well with an adequate coefficient of uniformity of 0.85. Each of the systems shows a wide range of coefficients even with the obvious system problems removed.

The most uniform application method evaluated was the tanker spreader, although each spreading method has room for improvement. With improved management each system can increase the uniformity of application. More effort needs to be made by farmers, researchers, and manufacturers to get uniform manure applications.

Farms need to apply the manure as evenly as fertilizer should be applied. One way is to apply thinner multiple applications. These would average out the variations in each specific pass with the spreading equipment. Using the proper pump capacity to obtain the recommended pressures for irrigation equipment will help increase the uniformity. Avoiding windy conditions would eliminate the problem of wind distortion. Night or early morning application when the wind is calmer could help.

Calibrating the spreading system and determining the uniformity of the system, whether it is a tank spreader or an irrigation system, is essential to determine if a system is spreading the manure the way fertilizer should be spread. Overlapping applications appropriately to get a more even spread should be considered but determined individually for each system.

Table 1. Comparison of the coefficient of uniformity of various manure spreading systems

	Drag Hose	Center Pivot	V-Spreader	Traveling Gun	Tanker Spreader
	0.61	0.51	0.30	0.35	0.58
		0.70	0.41	0.58	0.60
			0.51	0.60	0.66
			0.59	0.60	0.68
			0.60	0.62	0.80
			0.67	0.66	0.81
				0.68	0.82
				0.78	0.85
					0.89
average		0.61	0.51	0.61	0.74
adjusted average		0.70	0.59	0.66	0.76

Weed Control

Roundup Ready Soybeans Have Successful Introduction

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Roundup Ready™ Soybeans, which were commercialized in 1996, met or exceeded the expectations of 90% of the 1,058 U.S. growers surveyed following the growing season. Survey results also indicated that 74% of the growers made only one application and that 24% made two applications of Roundup® or Roundup Ultra® after crop emergence. On average, only 3% of the applications were made with a tank mix partner. In addition, only 18% of the respondents applied residual herbicides prior to soybean emergence.

In November, 92% of the growers surveyed indicated that they were satisfied or very satisfied with Roundup Ready Soybeans and 88% of them indicated that they would definitely or probably plant them again in 1997. These results indicate a very successful launch for this new technology and reflect the positive results of demonstrations/experiments conducted at Aurora and Valatie in 1995 and 1996.

1995 Demonstration

An unreplicated demonstration with Roundup Ready Soybeans was conducted at the Musgrave Research Farm near Aurora, New York in 1995. A field with a quackgrass sod was plowed and fitted prior to planting the soybeans on May 22. The demonstration included early postemergence (EPO) applications 4 weeks after planting (WAP) and late postemergence (LPO) applications 6 WAP. Roundup was applied at 1, 2, and 4 pt/A at each application timing, In addition, there was a standard treatment of 2.25 pt/A of Poast Plus and 1 qt/A of Basagran.

All treatments provided at least 90% yellow foxtail control. Roundup at 2 pt/A controlled 60 and 90% of the lambsquarters while 4 pt/A controlled 80 and 95% of the lambsquarters when applied EPO and LPO respectively. Quackgrass control with 2 pt/A improved from 70 to 80% when application was delayed two weeks. The standard treatment provided only 20 and 10% control of lambsquarters and quackgrass respectively.

Table 1. Quackgrass and annual weed control ratings with Roundup Ultra and with Select combinations at Valatie in 1996.

Herbicides	Amount/ Acre	% Control QUACK	CORAG	LAMBS	GRFOX
Roundup Ultra	2.0 pt	59	99	98	99
Roundup Ultra	3.0 pt	80	87	100	100
Roundup Ultra	4.0 pt	87	100	99	87
Select*	0.5 pt	40	100	29	89
Cobra	0.5 pt				
Basagran	1.0 pt				
Select*	0.5 pt	36	97	51	85
Cobra	0.5 pt				
Pinnacle	.13 oz				
LSD (0.05)		13	13	7	12

* Select combinations included 0.5% (v/v) COC.

Valatie 1996

Roundup Ready Soybeans (AG3001) were planted June 6 in a field with heavy quackgrass pressure along with a variety of annual weeds. Herbicides were applied 5 WAP. Results indicated that 3 pt/A of Roundup Ultra was required for acceptable quackgrass control (Table 1). Quackgrass control was only 59% with 2 pt/A while 3 and 4 pt/A provided 80 and 87% control respectively. The Select combinations controlled an averaged of 38% of the quack-grass. Common ragweed and green foxtail control were good to excellent with all Roundup Ultra and Select combinations. Roundup Ultra also provided excellent lambsquarters control compared with the Select combinations. There were no significant differences in soybean yield among the herbicide treatments. Their average yield was 46 bu/A compared with 33 bu/A for the untreated check.

(see ROUNDUP, page 7)

Table 2. Annual weed control ratings with Roundup Ultra and with Select combinations at Aurora in 1996.

Herbicides	Amount/ Acre	% Control VELVET	CORAG	LAMBS	GRFOX
Roundup Ultra	1.5 qt	89	97	100	99
Roundup Ultra	2.0 qt	98	99	100	99
Select*	0.5 pt	99	100	73	77
Cobra	0.5 pt				
Basagran	1.0 pt				
Select*	0.5 pt	83	99	83	79
Cobra	0.5 pt				
Pinnacle	.13 oz				
LSD (0.05)		9	3	8	9

* Select combinations included 0.5% (v/v) COC.

Farm Management

Agricultural Environmental Management - Assisting Farmers Assess the Environmental Stewardship of their Farming Operations

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The Agricultural Environmental Management (AEM) initiative is a new, multi-agency program designed to assist farmers implement environmental stewardship practices on their farms. This voluntary, educational, and incentive-based program is coordinated at the state level by New York State Departments of Agriculture and Markets, Environmental Conservation, Health, and State, Natural Resources Conservation Service, Soil and Water Conservation Districts, and Cornell Cooperative Extension among others. Local working groups, including representatives from these organizations, are currently being organized to implement this program at the county or watershed level.

A focal activity of this initiative is conducting farm environmental assessments using the "Tiered Approach." The "Tiered Approach" was developed and initially tested by the Skaneateles Lake Watershed Agricultural Program. This approach uses a combination of farm environmental assessment worksheets and whole farm planning processes to evaluate potential environmental impacts due to farming activities and recommend practices to mitigate these impacts. Counties associated with the Skaneateles Lake, Keuka Lake, Wappingers Creek, and Upper Susquehanna Coalition Watershed Agricultural Programs are currently using some form of this approach. Another 22 counties have recently been awarded grants from the New York State Non-Point Source Control and Abatement Grant Program to implement Tiered Approach farm environmental assessments within specific watersheds in their counties.

The farm environmental assessment worksheets used in the "Tiered Approach" are based on Farm*A*Syst worksheets, which are being used as educational and assessment tools in over 30 states. These worksheets are designed to help farmers and agricultural agents identify potential environmental concerns associated with current farming practices as well as identify practices which would provide an enhanced level of environmental stewardship. For each farming practice, the worksheets provide descriptions of four farm practices. These practices range from practices exhibiting high levels of environmental stewardship to practices associated with high environmental risks. For example:

	Rank 4	Rank 3	Rank 2	Rank 1
Cultural Pest Control	Cultural methods of controlling pests are working with desired insect populations resulting.	Cultural methods of controlling pest are working most of the time.	Cultural methods of controlling pests are not working most of the time.	Cultural methods do not control pest at all.
Soil Testing	Cropland fields have been tested annually.	Cropland field tested every 3 years.	Cropland fields tested every 4 to 6 years.	No soil testing in the last 7 years.
Manure Application Rates	Manure is applied at rates that do not exceed the N needs of the crop to be grown	Manure is sometimes applied at rates that exceed the N needs of the crop to be grown.	Manure is frequently applied at rates that exceed the N needs of the crop to be grown.	Manure is applied at rates that exceed the N needs of the crop to be grown.

These worksheets can be used as assessment, educational, and program development tools. As an assessment tool, these worksheets can be used to assist farmers and their neighbors recognize the environmental protection afforded by farming practices as well as to assess the potential detrimental environmental impacts of farming practices. As an educational tool, these worksheets can assist agricultural agents and farmers understand the relationship between farming practices and environmental resource quality and develop whole farm plans to address identified environmental concerns. As a program development tool, these worksheets can be used to involve farmers and non-farm community members in the identification of environmental quality impacts across the watershed and in the development of programs and interactions to facilitate the implementation of practices to mitigate these impacts. The following processes have been used in watershed programs to enhance the effectiveness of worksheet assessments.

• Farmers should be assured that farm environmental assessments are confidential. Based on assessments conducted, farmers

(see AEM, page 7)

Crop Management

Rotated Corn Can Enhance Corn Yields with Less Inputs

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All growers recognize the benefits of an alfalfa/grass sod to the subsequent corn crop. Unfortunately, many growers have not recognized or fully exploited the rotational benefits of other crops, such as soybean, wheat, oats, etc. We conducted field-scale studies (~10 acres) in four counties to demonstrate to New York cash grain producers the benefits of soybean and wheat/clover to the subsequent corn crop. We compared yields of continuous corn (C-C-C) under conventional management (soil insecticide, broadcast herbicides, ~140 lbs N/acre) with corn yields in a soybean-corn (S-C) or soybean-wheat/clover-corn (S-W/Cl-C) rotation with reduced inputs (banded herbicide plus cultivation, ~80-100 lbs N/acre).

Rotated compared with continuous corn yielded greater than continuous corn did at most sites in all years (Table 1). A significant rotation by site interaction existed each year because rotations responded differently at each site. In Cayuga Co., the S-C rotation yielded 15, 22, and 19 bu/acre greater than the C-C-C rotation in the 3 years. In contrast, the S-W/Cl-C rotation yielded greater than the C-C-C rotation only in 1995. In Seneca Co., the S-W/Cl-C rotation yielded 25, 28, and 20 bu/acre greater than the C-C-C rotation in the 3 years. In Orleans Co., the S-C and S-W/Cl-C rotations yielded greater than the C-C-C rotation in 2 of 3 years. In Yates Co., the S-C and S-W/Cl-C rotations yielded greater than the C-C-C rotation in only 1 of the 3 years. Clearly, the rotation effect is real but not quite as consistent as expected because of the reduced inputs in the S-C and S-W/Cl-C rotations.

For example, the PSNT values (Table 2) in the S-C rotation in 1994 were lower than expected (40 to 55 bu/acre soybean yields at the three sites in 1993). Consequently, our 80 lb N/acre application rate to rotated corn resulted in N deficiency and reduced yields at Orleans and Yates Co. in the high-yielding 1994 growing season. Research from the Midwest indicates that soybean N credits to the subsequent corn crop vary considerably from year to year so soil NO_3-N concentrations should be monitored closely to avoid overfertilizing or underfertilizing corn following a soybean crop.

Production problems associated with the S-W/Cl-C rotation included low corn plant populations under chisel tillage at Cayuga Co. in 1994 (data not shown), low PSNT values in 1996, and high weed densities at Orleans and Yates Co. in 1996 (Table 3). Research from Guelph, Ontario suggests that wheat (and perhaps clover) could have potential allelopathic effects of corn in reduced tillage systems, which would reduce corn stands and

Table 1. Corn grain yields under three crop rotations at four sites in 1994, 1995 and 1996.

	1994				1995				1996			
Rotation	Cayuga	Orleans	Seneca	Yates	Cayuga	Orleans	Seneca	Yates	Cayuga	Orleans	Seneca	Yates
	bu/acre											
C-C-C	154	142	112	156	148	110	87	125	130	113	101	116
S-C	169	140	127	137	170	118	103	153	149	119	116	121
S-W/Cl-C	157	163	137	161	164	123	115	152	129	110	121	115
LSD 0.05	12	10	11	5	14	8	17	14	18	5	13	NS

(see CORN, page 7)

reduce yields. They advocate baling the wheat straw and killing the clover in late fall to minimize any potential risks. The high weed densities at two sites in 1996 in S-W/Cl-C rotation indicate that rotating to a cool-season crop could actually increase rather than decrease weed competition in corn. Finally, the low PSNT values in the S-W/Cl-C rotation in 1996 indicate that clover N credits also vary greatly across years to the subsequent corn crop.

The S-C rotation vs. continuous corn increased corn yields in 9 of the 12 site-years, and the S-W/Cl-C rotation increased corn yields in 6 of the 12 site years. Because of less inputs in rotated corn, S-C rotation vs. continuous corn was more profitable in 11 of 12 site-years and the S-W/Cl-C rotation was more profitable in 12 of 12 site-years (data not shown). We strongly advocate more rotated corn on cash grain operations. Rotated corn, however, requires closer management of the crop because of the real potential to decrease inputs while enhancing corn yields.

Table 2. Soil NO_3-N concentrations of the presidedress nitrogen test (PSNT) under three crop rotations at four sites in 1994, 1995, and 1996.

	1994				1995				1996			
Rotation	Cayuga	Orleans	Seneca	Yates	Cayuga	Orleans	Seneca	Yates	Cayuga	Orleans	Seneca	Yates
	ppm											
C-C-C	8	10	6	7	14	10	10	11	7	0	9	4
S-C	16	9	10	8	19	19	14	17	11	2	11	8
S-W/Cl-C	15	11	19	29	25	24	21	21	11	1	12	2
LSD 0.05	5	NS	NS	8	10	NS	NS	NS	NS	NS	NS	2

Table 3. Weed density in late June under three crop rotations at four sites in 1994, 1995, and 1996.

	1994				1995				1996			
Rotation	Cayuga	Orleans	Seneca	Yates	Cayuga	Orleans	Seneca	Yates	Cayuga	Orleans	Seneca	Yates
	weeds/m^{-2}											
C-C-C	2.1	-	2.3	0.7	0.9	1.6	0.3	1.6	2.0	1.7	0.3	1.0
S-C	1.9	-	1.0	2.0	2.0	2.8	0.3	1.8	1.4	1.6	0.2	2.7
S-W/Cl-C	1.9	-	1.5	2.7	1.6	1.3	0.2	0.9	1.5	6.4	0.7	10.0
LSD 0.05	NS		NS	1.3	NS	NS	NS	NS	NS	2.2	NS	2.7

Crop Management

Bt Corn: Possibility for Management of European Corn Borer and Anthracnose Stalk Rot?

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European corn borer (ECB) is a common pest of New York field corn. Signs of ECB injury can be found in many fields, fortunately losses are usually not significant. Still other fields do sustain reduced grain yields. Management of ECB is complicated by the presence of strains producing two generations per season, extending the potential for ECB moths to lay eggs in fields from the whorl through grain fill stages. Once ECB larvae tunnel into corn plants they are protected from insecticide treaments making timing of within season treatments a challenge.

The overall economic impact of ECB in field corn in New York is not well understood. One reason is that ECB populations and potential damage vary considerably from location to location and year to year. In fields where ECB has been a historical problem, preseason crop management decisions, i.e., choosing hybrids with good yield potential and high standability ratings, delaying planting, and avoiding early maturity hybrids management decisions can minimize ECB impacts.

Experimental studies have shown that corn grain loss *per* ECB larva *per* plant are higher when ECB attack at vegetative stages than at reproductive growth stages. New York researchers found severe grain losses of 12 - 46% resulted from the combined presence of ECB and the anthracnose fungus, *Colletotrichum graminicola*. These losses were in excess of losses induced by either pest alone. Stem wounds created by ECB larvae are sites of infection by the anthracnose fungus that occurs commonly in New York, especially in continuous corn fields following conservation tillage.

In 1996, transgenic (Bt) corn hybrids, containing a protein from the bacterium, *Bacillus thuringensis*, that is toxic to ECB, became available commercially. Studies indicate that Bt hybrids can protect corn from ECB, often providing greater than 90% control. Bt corn is an attractive option for it's pest specificity, environmental and mammalian safety, and potential, season long control. It also increases the price of corn seed.

There is concern that this technology be used appropriately to avoid development of Bt resistant ECB populations. Bt resistance would have significant implications since ECB also attacks wheat, soybean, snap beans, potatoes, onions, apples, and nearly 200 other plant species. Further research is necessary to help define the judicious use of this technology. Some constraints of this technology were presented in an earlier What's Cropping Up? article by Elson Shields (see WCU vol. 6, no. 6).

In 1996, Cornell researchers initiated studies at the Musgrave Farm to assess the potential of Bt corn hybrids for efficacious and economical management of the ECB/ anthracnose pest complex in silage corn.

Hybrids of 100-106 day maturity rating, including four Bt hybrids, their non-Bt counterparts, and a standard non-Bt hybrid (Pioneer 3525) were compared. Plants were inoculated with the anthracnose fungus at the mid-whorl growth stage. ECB occurred naturally in the test plots. Plots were evaluated from tasseling through grain fill for signs of ECB injury and anthracnose stalk rot (ASR). Plots were harvested for silage on 10 October.

Table 1 shows pest injury ratings 2 weeks before harvest and silage yield. Detectable ECB feeding injury was near 0 for all Bt hybrids at all sampling

(see Bt Corn, page 7)

Hybrid	% Plants w/ tunnels stalk+shank	% Plants w/ ASR	ECB larvae per plant	Silage yield T/A
Pioneer 3525	40.00 bcd	15.00 cd	0.36 abc	19.72 a
YieldGard™ Mon810 (Bt+)	0.00 a	0.00 a	0.00 a	18.75 a
B73/Mo17	43.75 bcd	11.25 bcd	0.51 bc	16.63 b
Mycogen X6821NG (Bt+)	2.50 a	2.50 ab	0.09 ab	16.51 b
Mycogen X5790	35.00 bc	12.50 bcd	0.55 c	15.84 b
N. K. YieldGard X4734 CBR (Bt+)	1.25 a	6.25 a	0.00 a	16.57 b
N. K. N4640	47.50 cd	22.50 d	0.68 c	16.25 b
Ciba Maximizer 101 (Bt+)	7.50 a	3.75 ab	0.20 abc	15.80 b
Ciba 4372	26.25 b	12.50 bcd	0.44 bc	17.02 b

Within a column, means followed by the same letter are not significantly different as indicated by LSD (P=0.05). Silage yields adjusted to 65% moisture.

(ROUNDUP, from page 2)

Aurora 1996

Control of velvetleaf, green foxtail, and a variety of other annual weeds was investigated at the Musgrave Research Farm in 1996. Roundup Ready Soybeans (AG3001) were planted on June 3 and sprayed 4 WAP when they were in the second trifoliolate leaf stage. As little as 1.5 pt/A of Roundup Ultra provided at least 97% control of common ragweed, common lambsquarters, and green foxtail (Table 2). Velvetleaf control was 89 and 98% with 1.5 and 2 pt/A of Roundup Ultra respectively.

The Select-Cobra combination with Basagran provided excellent control of velvetleaf and ragweed but only 73% lambsquarters control. This combination with Pinnacle provided excellent ragweed control and controlled 83% of the velvetleaf and the lambsquarters. Green foxtail control with these Select combinations averaged 78%. Soybean yields for the two Roundup Ultra treatments averaged 50 Bu/A while yields from the Select combinations averaged 43 Bu/A.

(AEM, from page 3)

may be provided technical assistance and access to incentives to address identified environmental concerns.

- Farmers should be involved in the assessment process and provided with the completed worksheets. Work-sheets provided to farmers should contain information describing how implementing environmental stewardship practices can benefit the economic viability and long-term productivity of their farming operations as well as a list of written references and agencies or organizations that can provide additional assistance in conducting assessments or implementing stewardship practices.
- The formation farmer-based watershed advisory councils in conjunction with farm environmental assessments can provide producer input into revisions of worksheets and a peer review for whole-farm plans based on worksheet assessments.

If you would like to obtain copies of farm environmental assessment worksheets or additional information about the AEM initiative, please contact Barbara Bellows, AEM Outreach Coordinator/Cornell Cooperative Extension, at telephone: 607-255-4537 or email bcb5@cornell.edu or John Wildeman, AEM Technical Coordinator/NY Department of Agriculture and Markets at 518-457-3087.

(Bt Corn, from page 6)

dates. Bt hybrids had 4.7 fold fewer plants with anthracnose stalk rot symptoms than their non-Bt counterparts. The majority (82%) of plants with anthracnose stalk symptoms had an ECB tunnel. Although yields were similar among hybrids, three of four Bt hybrids had numerically higher yields than their non-Bt counterpart. Highest overall yields were obtained from Pioneer 3525, a standard non-Bt hybrid.

Bt hybrids showed promise in this initial study for enhancing management of the anthracnose stalk rot / ECB complex. Further studies are necessary to determine the efficacy of hybrids in reducing losses resulting from ECB and *C. graminicola* attack at corn vegetative stages, when yield impacts of this pest complex are likely to be the greatest.

Calendar of Events

June 5	Small Grain Field Day, Aurora, NY
July 2	Cornell Weed Day, Valatie, NY
July 13-16	Northeastern Branch ASA Meeting, University of Maryland, College Park, MD
July 15-16	Cornell Weed Days
August 1	CCA National and State Exams, Cortland, NY
August 9-13	American Phytopathological Society Annual Meeting, Rochester, NY
Oct. 26-31	American Society of Agronomy Meetings, Anaheim, CA

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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