What's Cropping Up?

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Timing is Critical for Liberty and Roundup Ultra Programs in Corn

R.R. Hahn and
P.J. Stachowski

The development of herbicide-resistant hybrids has heightened interest in total postemergence weed control programs for field corn. This new technology will provide control options for hard-to-control weeds, will favor the implementation of integrated weed management programs, and will provide the opportunity to use nonselective herbicides like Liberty (glufosinate) and Roundup Ultra (glyphosate) in ways not previously possible.

Both Liberty and Roundup Ultra have little or no residual soil activity and are viewed as environmentally friendly. However, timeliness of application may be more critical with these herbicides than with residual herbicides applied preemergence (PRE) or early postemergence. This was the case with experiments conducted in 1997. Although weed control was generally good with mid-postemergence (MPO) applications of Liberty or Roundup Ultra applied alone and in combinations, early weed competition resulted in yield losses.

Separate, though adjacent, field experiments were conducted with 'DK493GR' (glufosinate resistant) and 'Jeremy' (Roundup Ready) corn hybrids at Aurora. 'Jeremy' was planted May 26 and DK493GR was planted May 29. For comparison, a standard PRE treatment of 2.4 qt/A of Bicep II was applied the day of planting in each experiment. MPO treatments with Liberty or Roundup Ultra were applied 30 days after planting when the corn was 12 to 15 inches tall. Velvetleaf, redroot pigweed, common ragweed, and common lambsquarters were 4 inches tall or less while green foxtail was about 6 inches tall and wild mustard ranged from 6 to 12 inches tall with some in the bud stage.

The PRE application of Bicep II provided at least 95% control of all weed species in both experiments. The same was true with applications of 1.25 or 1.75 pt/A of Liberty except for velvetleaf and common lambsquarters. Velvetleaf control 7 weeks after treatment (WAT) was 84% when Liberty was applied alone and 91% when the 1.25 pt/A rate was applied with 1.5 pt/A of atrazine (Table 1). Common lambsquarters control 7 WAT was 73 and 82% with 1.25 and 1.75 pt/A of Liberty respectively. The tank mix of 1.25 pt/A of Liberty and 1.5 pt/A of atrazine controlled 100% of the lambsquarters (not triazine-resistant). Grain corn yield with the three Liberty treatments averaged 86 Bu/A while yield with the PRE Bicep II treatment and the untreated check were 104 and 40 Bu/A respectively (Table 1). Like grain yield, silage yield with the MPO application of 1.75 pt/A of Liberty was about 15% less (14.7 T/A) than with the PRE Bicep II application (17.3 T/A).

Application of as little as 1.5 pt/A of Roundup Ultra controlled at least 95% of all weed species except velvetleaf. Velvetleaf control with 1.5 pt/A of Roundup Ultra was only 75% 7 WAT (Table 2). Increasing the rate of Roundup Ultra to 2 pt/A

Table 1. Velvetleaf and common lambsquarters control 7 WAT with MPO applications of Liberty alone and in combination with atrazine compared with a PRE application of Bicep II.

Herbicides	Rate Amt/A	When Appl	% Control VELVET	% Control LAMBS	Yield Bu/A
Bicep II	2.40 qt	PRE	99	100	104
Liberty*	1.25 pt	MPO	84	73	82
Liberty*	1.75 pt	MPO	84	82	86
Liberty + Atrazine*	1.25 pt + 1.50 pt	MPO	91	100	89
Untreated	-	-	-	-	40
LSD (0.05)			15	12	18

*Applied with 3 lb/A ammonium sulfate

(see TIMING, page 7)

Soil Management

EPA rules for land application of sewage sludge are too lax, Cornell Waste Management Institute proposes

'Case for Caution' report calls for more restrictions to safeguard human health, agricultural productivity and environment

Growers who follow U.S. Environmental Protection Agency (EPA) rules in applying sewage sludge as fertilizer to their land may be inadvertantly endangering human health, the environment and the future productivity of their own crops, an analysis by the Cornell University Waste Management Institute has found.

"The potential for widespread use of sludge on agricultural and residential land, the persistence of many pollutants which remain in soils for a very long time and the difficulty of remediation" warrant tougher rules than the federal EPA and most state environmental agencies have established, the university-based institute states in a new report.

Some states, including New York, have regulations in place that are more strict than the EPA's "Part 503" rules, and producers and applicators of sludge products in those states must follow the applicable state regulations. However, no state's regulations are as strict as those recommended by the Cornell institute, or as restrictive as sludge-application regulations in some European countries and the Canadian province of Ontario.

The August 1997 publication of "The Case for Caution: Recommendations for Land Application of Sewage Sludge and an Appraisal of the U.S. EPAÕs Part 503 Sludge Rules" follows the earlier issuance of a bulletin from Cornell Cooperative Extension. That bulletin urged greater caution in sludge application to agricultural lands - and no sludge or sludge compost whatsoever on home gardens.

Explaining why a university-based organization is so vocal in opposing federal agency rules, institute Director Ellen Z. Harrison said: "We believe that the soil, water and crop conditions make these federal rules particularly inappropriate in New York state and the Northeast. As the land-grant university for New York state, it is Cornell's role to address this issue."

"We're not making a case for prohibition of sewage sludge in agriculture, but rather for more restrictive rules," said Harrison, one of three report authors (along with Murray B. McBride and David R. Bouldin, professor and professor emeritus, respectively, in the Department of Soil, Crop and Atmospheric Sciences at Cornell).

"Clearly there are societal benefits to recycling this material and potential benefits for agricultural productivity," said Harrison, a geologist. "But we are concerned that the EPA - in setting rules that are far less protective than those of many other nations - has made many overly optimistic or simplistic assumptions about contaminant impacts. We need to take a closer look at the contents of sewage sludges and the conditions under which they are applied before we make decisions that will affect agricultural productivity and human health, as well as the health of the environment for years to come."

Also known as biosolids, sewage sludges are the byproduct of municipal sewage-treatment processes. Separating liquids from treated sewage yields wastewater effluents and truckloads of an organically rich material - and a waste-disposal problem for municipalities. Until ocean dumping was outlawed, New York City and some other municipalities hauled sewage sludge off-shore. Two legal alternatives, incineration and landfilling, cost municipalities money. Land application of sewage sludge offers an attractive option because municipalities can sell the material, or at least contract with haulers to remove the material at lesser cost to taxpayers.

However, sewage sludge contains more than organic matter and agriculturally useful chemicals like nitrogen and phosphorus. Depending on what households, businesses and industries are flushing down the drains - and what is leaching from miles of pipes in every city - untreated sewage includes a mixture of heavy metals (such as lead, mercury and cadmium) and toxic organic chemicals (such as PCBs), as well as pathogens (including bacteria, viruses, protozoa and other parasites) from fecal matter.

Some sewage-treatment processes kill most pathogens, but heavy metals and other contaminants are concentrated in the dewatered sludge. Humans and other animals potentially can be exposed by contacting sludge contaminants on the surface of soils and plants, through ground- and surface-water movement of contaminants, and by eating plants that are grown in soils

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with heavy metals and other contaminants.

The Cornell Waste Management Institute's report lists 14 reasons why the EPA's sludge rules may not adequately protect human health and the environment. Among them:

• Contrary to EPA analysis, contaminants might find their way into drinking water, according to analysts at Cornell. They concluded that low mobility of contaminants is predicted by unrealistic laboratory simulations of water moving through soil packed in columns, rather than soil with natural channels created by worms, roots and other "macropore" processes. A Cornell study published in 1997 found metals in water percolating from fields where sludge was applied more than a decade earlier. Application of sludge according to EPA rules could possibly result in a violation of drinking-water standards in private wells, the report said.

• Sewage sludge contains phytotoxic (or plant-damaging) metals, such as copper, zinc and nickel that accumulate in soil and can reduce yields of the same crops the fertilizer is supposed to help. High concentrations of these metals also harm soil microorganisms that contribute to plant growth, while other metals in sludges can create dietary imbalances in animals that graze on plants growing in sludge-treated soil.

• Consumers who follow the USDA's diet recommendations are eating more plant-based foods than the EPA assumes - and may be consuming more heavy metals than the EPA predicts, the Cornell analysts found. They said the EPA's risk-assessment for heavy metals in fruits, vegetables and grains is incorrect because it based on the "average American" diet of the 1970s rather than the current American diet or the USDA-recommended diet with even more vegetables, fruits and grains. For example, the "EPA diet" has only one-fifth the amount of leafy vegetables (potentially a major source of dietary cadmium, a toxic metal, when grown in some sludge-amended soils) as the USDA-recommended diet. And the USDA diet contains 16 times the amount of fruit that the EPA assumes Americans are eating.

• The EPA does not require labeling of sludges and sludge products. Without labels, the Cornell institute suggested, consumers may assume that all sludge-based products are alike, when in fact the levels of contaminants and other properties vary widely.

The "Case for Caution" report includes more protective recommendations for farmers and for applicators of sewage sludge, as well as suggestions for stricter policies and regulations on the state and federal levels and advice for home gardeners who already have applied sludge products.

The Cornell institute was established in 1987 to address environmental and social issues associated with waste management through research, education and outreach.

Chemicals present in some sewage sludges at potentially harmful levels.

Chemical	Behavior
Arsenic	Non-essential. Can be taken up from soil into crops. Potentially toxic to animals and humans
Boron	Relatively soluble in soils. Essential to crops but toxic in excess
Cadmium	Taken up into leafy vegetables and forages. Cumulative toxin in animals and humans.
Copper	Essential to plants but toxic to roots in excess. Not readily taken up into foliage.
Lead	Insoluble in most soils, most transfer to humans and animals is by soil contamination of crops. Cumulative toxin in animals and humans.
Mercury	Not readily taken up by crops, can convert to volatile and more toxic forms in soil. Cumulative toxin in animals and humans.
Molybdenum	Essential to plants. Readily taken up by forage crops in high-lime soils. Can cause nutritional imbalance in ruminants at high levels.
Nickel	Taken up by crops, particularly in acid soils. May be essential to plants but toxic in excess.
Selenium	Taken up by crops in high-lime soils. Essential to animals, but excess in forage can be harmful.
Zinc	Taken up by crops, particularly in acid soils. Essential to plants but toxic in excess.
PCB's and dioxins	Not readily taken up into crops, but can transfer into fat and milk of grazing animals. Persistent in soils. Suspected carcinogens.
Detergent Chemicals	May degrade to more toxic compounds. Potential for leaching into groundwater.

Nutrient Management

Nutrient Management in the Northeast

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Introduction

Nutrient management is a popular topic these days. So much so, that a symposium devoted to nutrient management in the US was held at the recent national meeting of the American Society of Agronomy. A representative from each major geographic region was asked to report on the status of nutrient management in their region. Issues for discussion centered on a host of topics ranging from farmer acceptance to successes and failures. The status of nutrient management in the NE follows.

Summary of survey

Questionnaires were sent to extension soil fertility specialists in each of the 12 NE states (CT, DE, ME, MD, MA, NH, NJ, PA, RI, VT, WV, and of course NY) to poll facts and opinions. The results of the survey are presented in the adjoining table.

Every state in the NE has an active nutrient management program. Three of 12 states have some form of legislation that guides their program. The remaining states have no pending legislation in the pipeline. Nutrient management planning is conducted by a variety of groups, notably; Cooperative Extension and Soil and Water Conservation Districts, and to a lesser extent by NRCS, State Departments of Agriculture, and consultants. In most cases, field crops are the major crops considered in the plan, although in a few states, several vegetable crops are included.

Non-traditional waste management is becoming an important issue because more and more policy makers, municipalities, and private industry view land application as means to dispose/recycle urban wastes. Five of 12 states include non-traditional wastes, such as sewage sludge and food processing wastes, in the nutrient management plan.

Computer software is available in about half the states to assist with planning. Although there is a well established mechanism to certify nutrient management planners through the American Society of Agronomy's Certified Crop Advisor program, only 25% of the states require certification.

Perhaps one of the most controversial aspects of the program (not only in the northeast but in the US in general) is the fertilizer recommendations, which serve as the foundation for the nutrient management plan. There is often a difference, and sometimes a large difference, in recommendations between the university and private industry. Differing recommendations confuse the farmer and weaken the acceptance of the program. If the nutrient management program is to be successful, there needs to be more common ground among fertilizer recommendations. In most states, Cooperative Extension's recommendation is preferred, but not necessarily required, for the nutrient management plan.

Farmer's do not readily volunteer for the program. Their major concerns are real and relate to confidentially, retribution, expense, and most importantly, they feel it has only limited benefit. Opinions about the program (on a scale of 1= strongly against, 10= strongly favor) averaged 5.5 and 5.4 for farmer's and private industry, respectively. There were major shifts in opinion between states.

Increased awareness, credibility, and improved management were cited as the major successes of the program. Failures were associated with indifference, lack of educational effort, fragmentation, and the feeling there is little or no economic benefit.

Conclusion

Most agree there are definite advantages to nutrient management planning. However, the success of the program will hinge on a unified effort to develop educational programs, cost/benefit analysis, cause and effect relationships between land management and water quality, and most importantly, to develop a common ground to justify and unify the nutrient management recommendations.

Summary of Nutrient Management Programs in the Northeast.

State	Educational program	Enacted legislation	Pending legislation	Who conducts program?	Commodities	Non-traditional wastes	Software available	Planner certification requirement	Who's nutrient recommendations are used?	Do farmer's volunteer readily?	Farmer's concerns	Farmer's opinion (1-10)	Industry opinion (1-10)	Successes	Failures
Connecticut	yes	yes	no	CE*	field crops	no	no	none	University	no	no benefit, expense	7	2	offers credibility	no follow up, NRCS plan different than CE
Delaware	yes	no	no	CE, Cons Districts	field and some veg. crops	yes	no	none	University	no	retribution, expense	5	5	increased awareness, improved mgmt.	indifference, no long term planning, fragmented effort
Maine	yes	no	no	CE	field crops	no	yes	none	University	no	no benefit, retribution	3	9	better manure distribution	lack of interest
Maryland	yes	no	no	CE, Dep. of Ag.	field crops	yes	yes	MD certified	University	yes	confidentiality, independence	7	4	improved profits	loss of industry support
Massachusetts	yes	no	no	CE, NRCS, FSA	field and veg crops	no	no	CCA or FSA approved	University, industry	no	apathy	5	4	reduced fertilizer N use	lack of funding for educational effort
New Hampshire	yes	no	no	CE	all crops	yes	no	none	University	in some cases	retribution, loss of control	8	6	better N, and P mgmt	none
New Jersey	yes	no	no	CE, gov't agencies, consultants	field crops	yes	no	none	University	in most cases	time, expense	6	6	reduced N input using PSNT	getting soil samples taken
New York	yes	no	no	CE, Cons. Districts, consultants	field crops	no	yes	none	University, but not required in non-CE plans	no	retribution, expense, time, confidentiality	5	4	improved mgmt, offers credibility,	lack of interest, farmer's feel benefit is limited
Pennsylvania	yes	yes	no	CE, gov't agencies, consultants,	manured crops	no	yes	PA-Dep. Ag certified	University, others with justification	no	cost, getting caught in regulatory web	4	6	increased awareness, improved mgmt	insufficient education for policy makers and gov't officials
Rhode Island	yes	no	no	CE, NRCS, Cons. Districts	corn, potatoes	yes	no	none	University if cost shared	no	retribution, confidentiality	6	5	conflict resolution	too much paper work
Vermont	yes	yes	no	CE, gov't agencies, consultants	all crops	no	yes	none	University, but not required	no	limited benefit	?	?	increased awareness, better mgmt	farmer's feel benefit is limited
West Virginia	yes	no	no	CE, NRCS, State Cons. Agency	corn, hay, alfalfa, pasture	no	no	none	University preferred by State Soil Cons. Committee	in most cases	limited benefit	5	8	it's a subset of a larger crop mgmt program	not enough planners

* abbreviations; **CCA**: certified crop advisors, **CE**: Cooperative Extension, **Cons**: conservation, **FSA**: Farm Service Agency, **NRCS**: Natural Resource Conservation Service

CROP MANAGEMENT

Recommended Soybean Varieties for 1998

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New York soybean acreage increased significantly to about 110,000 acres in 1997 compared with about 80,000 acres in 1996. A favorable soybean to corn price ratio as well as an increased awareness of the benefits of crop rotation to corn yields contributed to the 37.5% increase in soybean acreage. The continued favorable soybean to corn price ratio may result in increased soybean acreage in 1998. We recommend the following soybean varieties in 1998, based on our variety trials over the last two years.

Central and Western NY

We recommend to plant about 50 to 60% of the acreage to Group I varieties, 20-40% to Group II varieties, and about 10-20% to Group 0 varieties in the main soybean production areas in central and western NY. Recommended Group 0 varieties, which are typically ready for harvest in mid-September, include TS093, Pioneer 9071, APK 020 and Korada (Table 1). Bayfield, which is planted extensively in Ontario, Canada, yielded exceptionally well at Mt. Morris last year. Nevertheless, we recommend Group 0 varieties in central and western NY only when growers wish to plant wheat in September after soybeans.

Group I varieties have yielded as well as Group II varieties at Aurora and Mt. Morris for the past 2 years so soybean growers should plant at least 50% of the acreage to Group I varieties. Recommended Group I varieties include S19-90, TS194, APK184, CX173, and Pioneer 9172. The new Golden Harvest variety, H1191, appears well-adapted to central and western NY growing conditions.

Table 1 Yields of recommended early (Group 0), medium (Group I), late (Group II), and Roundup Ready soybean varieties at Aurora and Mt Morris in 1996 and 1997

	AURORA		MT MORRIS		MEAN
Variety	1996	1997	1996	1997	
		Early			
Terra TS093	53	50	56	60	55
Pioneer 9071	50	41	59	56	52
Agway APK020	54	40	57	55	52
Agway Korada	52	40	50	59	51
OAC Bayfield	-	44	-	68	-
		Medium			
NK S19-90	68	52	70	67	64
Terra TS194	74	45	75	63	64
Agway APK184	67	54	70	66	64
DeKalb CX173	62	55	64	72	63
Pioneer 9172	68	46	75	57	62
Golden Harvest H1191	-	56	-	66	-
		Late			
DeKalb CX232	68	50	71	72	65
Terra TS253	66	49	71	68	64
DeKalb CX229	66	50	65	71	63
Mycogen J-251	65	48	71	68	63
DeKalb CX252	59	49	70	69	62
Terra TS200	64	49	67	66	62
Mycogen 200	64	47	70	69	61
Agway APK243	-	51	-	68	-
Golden Harvest H1211	-	50	-	68	-
Pioneer 9242	-	47	-	66	-
		Roundup Ready			
Asgrow AG2401	-	48	-	72	-
Asgrow AG2701	-	49	-	70	-
Pioneer 9294	-	53	-	65	-

Group II varieties, which were not ready for harvest until mid-October in 1997, have yielded 69 bu/acre compared with 64 bu/acre for Group I varieties over the last 5 years. Consequently, soybean

Table 2 Yields of recommended early (Group 00/0) and medium (Group I) soybean varieties at Canton and Chazy in 1996 and 1997

	CANTON		CHAZY		MEAN
Variety	1996	1997	1996	1997	
		Early			
OAC Bayfield	58	46	69	55	57
Agway APK 020	53	51	69	53	57
OAC Brussells	57	41	63	59	55
Terra TS093	50	51	60	56	54
Pioneer 9071	56	43	65	50	54
Agway Korada	49	44	65	53	53
Terra TS084	54	46	58	50	52
		Medium			
Terra TS194	59	45	71	63	60
DeKalb CX173	63	40	66	59	57
NK S19-90	-	49	-	62	-
Pioneer 9132	-	43	-	64	-

RESIDUE

growers who begin planting before May 25 should select Group II varieties for 20 to 40% of their acreage. Recommended Group II varieties include three DeKalb varieties, two Terra varieties, and two Mycogen varieties. APK243, H1211 and Pioneer 9242 are promising new Group II varieties.

We planted a Roundup Ready soybean variety trail for the first time in 1997. The Group II Roundup Ready varieties, AG2401, AG2701, and Pioneer 9294 yielded as well as the recommended Group II soybean varieties. Furthermore, the Roundup Ready trial had excellent weed control with just the Roundup application, whereas the other soybean trails required additional hand-weeding. Roundup Ready technology is here so we recommend that soybean growers select some Roundup Ready varieties.

Northern New York

We recommend to plant about 20% of the acreage to Group I varieties and 80% of the acreage to the Group 00/0 varieties. TS194 and CX173, which should be planted before May 25 in northern NY, have yielded well for the last 2 years (Table 2). S19-90 and Pioneer 9132 also yielded well last year.

Recommended Group 0 varieties include Bayfield, APK020, Brussells, TS093, 9071, Korada, and TS084. Group 0 varieties usually yield as well as Group I varieties in most locations in northern NY. Consequently, we recommend to plant most of the acreage in northern NY to these varieties.

(TIMING, from page 1)

or applying the 1.5 pt/A rate with 2 pt/A of atrazine improved velvetleaf control to 90 and 94% respectively 7 WAT. Grain corn yields with the 1.5 or 2 pt/A rates of Roundup Ultra alone averaged 87 Bu/A and were significantly lower than the 111 Bu/A yield from the PRE Bicep II treatment. On the other hand, the MPO Roundup Ultra plus atrazine treatment resulted in a grain corn yield similar (107 Bu/A) to that with PRE standard (Table 2). Corn silage yields for the PRE Bicep II treatment and the 2 pt/A Roundup Ultra treatment were 25.4 and 21.2 T/A respectively.

Yield losses experienced with the MPO Liberty and Roundup Ultra programs were a bit surprising since rainfall for June (the period between planting and MPO applications) was 3.9 inches compared with a normal total of 4 inches. Although weed control was good to excellent with these MPO programs, early competition, especially from wild mustard resulted in yield losses compared with the PRE standard program. Corn growers should be reminded that the number of rows of kernels on the ear have already been determined by the time eight corn leaves have fully emerged and cannot be increased from this point on. As a result, stress at this stage of development (about 4 weeks after emergence) can reduce yield potential.

Table 2. Velvetleaf and common lambsquarters control 7 WAT with MPO applications of Roundup Ultra alone and in combination with atrazine compared with a PRE application of Bicep II.

Herbicides	Rate Amt/A	When Appl.	% Control VELVET	% Control LAMBS	Yield Bu/A
Bicep II	2.4 qt	PRE	95	100	111
Roundup Ultra	1.5 pt	MPO	75	99	85
Roundup Ultra	2.0 pt	MPO	90	100	90
Roundup Ultra +	1.5 pt	MPO	94	100	107
Atrazine	2.0 pt	MPO			
Untreated	-	-			14
LSD (0.05)			8	1	15

Calendar of Events

December 10-11	CCA Training, Triphammer Conference Center, Ithaca, NY
December 17	Zone Tillage Dealer Meeting, Holiday, Inn, Waterloo, NY
December 18	Zone Tillage Grower Meeting, Holiday Inn, Waterloo, NY
December 19	Zone Tillage Grower Meeting, Holiday Inn, Batavia, NY
January 5-6	NYSABA Annual Meeting, Holiday Inn, Waterloo, NY
January 5-8	Northeastern Weed Science Society Meeting, Washington, DC
January 20	Finger Lakes Corn Congress, Holiday Inn, Waterloo, NY
January 21	Western New York Corn Congress, Holiday Inn, Batavia, NY
January 22	Winter Crop Meeting, Triphammer Conference Center, Ithaca, NY
February 6	CCA Exams, Geneva, NY, Dover, NH, Presque Isle, ME, and Hatfield, MA
February 9-12	Weed Science Society of America Meeting, Chicago, IL
February 24	North Country Corn Congress, Miner Institute, Chazy, NY

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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