What's Cropping Up?

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Update on CCA Program

Bill Cox
Soil, Crop and
Atmospheric Sciences

The Certified Crop Adviser (CCA) Program, a voluntary certification program for agricultural professionals, is now active in 40 states nationwide. To become a member of the CCA program, an individual must have a minimum level of education/crop advising experience (BS in Agriculture with 2 years of crop advising experience or 4 years of crop advising experience), pass a national and state exam, sign a code of ethics, and participate in 40 hours of continuing education units (CEUS) every 2 years. Nationally, about 12000 individuals have taken the national exam since the inception of the program 2 years ago.

Credential Forms

About 4800 individuals took the national exam in February 1995 and about 70% passed. About 145 New Yorkers took the February exams and 77% passed the national and 74% passed the NY State exam. Overall, 100 New Yorkers, who passed both exams in February, are eligible to become CCAs. These individuals must now send in the certification or credential forms to the American Society of Agronomy (ASA) in Madison, WI by July 1. Once the ASA office receives the credential forms, ASA will forward the forms to the NY State CCA Board. The NY State CCA Standards and Ethics Committee (Greg Bodine, John Deibel, Dave Dodge, and Rich Wildman) will review the credential forms. If the credential forms meet all the criteria, the NY CCA Board will approve the credentials and return them to the ASA office in Madison. The ASA office will then notify the individual that they are eligible to become a CCA if they sign the Code of Ethics. Once the Code of Ethics is signed, the individual becomes a CCA.

CEU Program

About 50 New Yorkers passed both the national and state exams in August '94, and about 40 have become CCAs. These 40 registered CCAs in New York must receive 40 CEUs by July '97, including a minimum of 10 CEUs by July '96, to maintain CCA eligibility. Furthermore, at least 5 of the 40 CEUs must be in each of the four competency areas: nutrient management, soil and water management, integrated pest management (IPM), and crop production.

The NY CCA Board urges all sponsors of agricultural educational programs in New York to apply for CCA credits (i.e. CEUs) to meet the demand. To receive CCA credits, the sponsor of the program must send a copy of the educational program (include titles, speakers, and times) to the New York Agricultural Business Association (ABA), John Deibel, NY CCA State Agent, 684 Olden Road, West Falls, NY 14170. John will forward the program to the NY CCA Educational Committee (Bill Cox, Fred Gaffney, and Mike Karr), who will assign CCA credits. After the Educational Committee reviews the program, it will be sent back to John, who will assign a unique number to it along with the appropriate CCA credits. The ASA will then send computerized forms to the sponsor of the educational program. Attendees, who are CCAs, at the program will fill in their ID number on a computerized form. The sponsor will collect and return all computerized forms to ASA for further processing. A CCA, who prefers to manage their own forms, has the option of sending their own computerized form directly to the ASA office.

Summary

New York now has an active CCA program. Individuals, who passed both exams in February, must send in the credential forms to ASA immediately. Sponsors of agricultural educational activities this summer should apply for CCA credits immediately. Registered NY CCAs should attend some educational activities this summer to partially satisfy the 40 CEU requirement.

FORAGE MANAGEMENT

Nutrient Flows on Dairy Farms: An Integrated Approach

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Agricultural and Biological Engineering

Increasingly, farm management decisions need to be based not only on economic results but also potential environmental impacts. To do this, the farm has to be viewed as an interconnected system of components that include the farm manager, crops, soils, animals, manure, ground and surface waters, pests, and pathogens. A team of scientists at Cornell, headed by Dan Fox of Animal Science, is working to develop an integrated approach to evaluating the impacts of farm management decisions on profitability and air and water quality. The project, known as "Integrating Knowledge to Improve the Sustainability of Dairy Farms in New York State," includes scientists from Agricultural, Resource, and Managerial Economics (ARME); Agricultural and Biological Engineering (ABEN); Animal Science; Education; Entomology/IPM; Soil, Crop, and Atmospheric Sciences (SCAS); the College of Veterinary Medicine's Diagnostic Laboratory; the NYS Water Resources Institute; and Cornell's Center for the Environment.

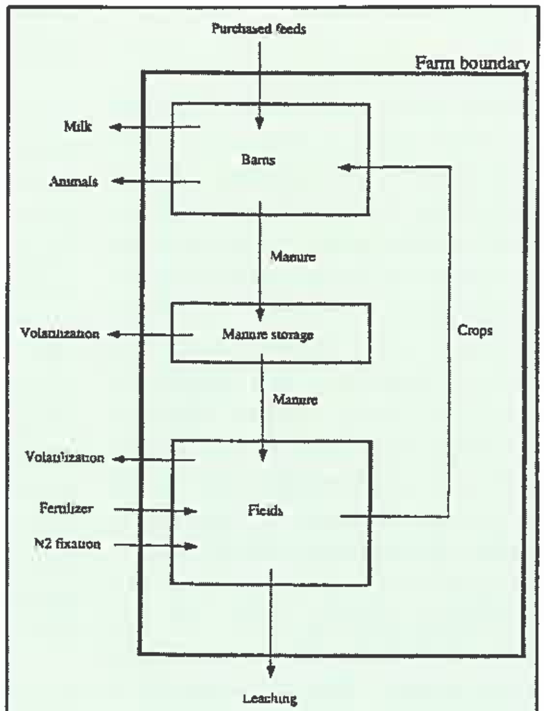
As part of this project, nutrient flows and pathogen prevalence on two case study farms are being analyzed. Overall mass balances on a number of New York dairy farms have been determined by Stu Klausner, SCAS, and indicate that as much as two-thirds of the nitrogen, phosphorus, and potassium imported onto dairy farms as feed, fertilizer, and nitrogen fixation are not accounted for in the export of milk and animals. These retained nutrients can accumulate on the farm or escape into the water or air. Thus, one of the project's goals is to determine where the retained nutrients are going: building up in the soil, flowing out in the ground or surface waters, or (in the case of nitrogen) escaping into the air.

Shown in the figure are the flows of nutrients that were evaluated on the case study farms. Each arrow represents a movement of nutrients. Components of the farm are divided into a barns subunit, a manure storage subunit, and a fields subunit. Nitrogen losses in the manure handling system were determined by Rick Koelsch, formerly of ABEN. Manure was sampled at excretion, before storage, and after storage. Losses of nitrogen through volatilization on the barn floor and in storage were estimated from a mathematical model. Leaching of nitrogen into the groundwater was estimated by John Hutson and Jeff Wagenet of SCAS using their LEACHN model. This model was applied to the fields in small sections called pixels, giving a detailed view of nutrient pathways in the soils.

A substantial percentage of the nitrogen in the manure volatilizes from the barn floor. These barn floor losses depended on time of year. When barn temperature was 40 degrees, losses were less than 10%. At 70 degrees, losses were 35 to 40%. Total losses of nitrogen in manure handling and storage were 16% of excreted nitrogen.

Inputs of nitrogen to the fields in the forms of manure, fertilizer, and fixation were estimated. Outflows from the field were uptake by the crops, losses to the atmosphere (volatilization and denitrification), and leaching of nitrates to the groundwater. About 9% of the inputs to the fields were predicted to leach to the groundwater. However, about 70% of these leaching losses occurred on only 25% of the land area, and were associated with the most well drained soils.

A Nutrient Management Plan was developed by Stu Klausner for these farms. The environmental benefits of following the plan were estimated, and a substantial reduction in the retention of nutrients on these farms is predicted. Near term efforts involve examining the economic costs and savings of the Nutrient Management Plan, considering alternative methods of manure handling, and developing cropping programs that limit leaching on the well drained soils. Each of these questions will require an integrated approach to obtaining an answer.



Division of the farm into subunits, and flows of nutrients between subunits and across the farm boundary.

Three Years of Compost Applications to Corn Plots; Findings and Recommendations

John H. Peverly
Department of Soil, Crop and Atmospheric Sciences

SOIL MANAGEMENT

Large additions of organic matter to cropped soils require not only knowledge of and monitoring for contaminant buildup, but also the ability to manage shorter-term crop-growth factors and potential water quality problems. These can include excessive soluble salts, soluble plant toxicants, and nitrates in crop deficient or excessive supply. In humid temperate areas like New York State, the first two impacts would be short-lived if present at all.

In the case of materials like sludge or municipal solid waste (MSW) composts, benefits include major and minor nutrient additions and soil property improvements such as increased water and nutrient-holding capacities and increased aeration or drainage of amended soils. This is exemplified usually as a decrease in soil bulk density (BD). Risks are both short and long-term. In the short term, concerns are for developing accurate N-based application rates combined with N fertilizer recommendations. The long term focus is on chemical contamination by metals of soil, the food chain, or groundwater.

Field Trials

A three-year, replicated plot study was initiated in the spring of 1992 on the Lott Farm in Seneca County for continuous corn. Two composts, an MSW plus sludge compost and a low-metal sewage sludge plus woodchips compost, were each applied in May of 1992, 1993 and 1994 at nominal rates of 20, 40 (agronomic rate), and 80 dry tons/acre and incorporated. The composts exhibited C/N ratios of 22 and 14 respectively in 1994. In 1992 and 1993, the ratios were about 10 for both. Both composts qualified as DEC Class I composts which can be applied under current regulations to all crops except those for direct human consumption (with no processing).

Other plots used for control purposes were treated with conventional fertilizers or left totally untreated. Several plots were split, so that some compost-treated plots also received inorganic-N fertilizer. Data on yield, and soil, crop, and water quality were collected.

Results

There were no treatment effects of compost applications on germination or stand counts, or on grain quality. Stover tissue contents for Cu, Zn and Ni were increased by compost treatments, but not to levels thought threatening to plant health or animal feed quality. Soil metal levels increased (2-6x background) but not to levels of concern (10-50x background). In soil pore water samples taken in September, 1994, from high rate (80 dry t/acre) MSW plots, concentrations of B, Na, Ni, and Se were 5 to 10 times greater than controls. These results are not unexpected and, though bear watching if more compost applications were to be made, are not considered risky to the food chain or environment.

Various positive effects on soil characteristics are noted in Table 1. The organic matter increases and bulk density (BD) decreases are manifested in the plots as a softer, more porous rootzone which resists extremes in moisture supply. Nutrient supply is also elevated by the three compost applications, as indicated by K and P levels. Pore water nitrate in April, 1995, was slightly elevated for plots treated at agronomic rates compared to controls, but were well below the

Table 1. Soil data for corn plots treated with MSW (DE) and sludge (MA) composts applied three years (1992-94) at about 40 dry tons/acre. C = control, CV = conventially fertilized control (100 lbs N/a). Means (± SE).

		Soil, July 1994			
CORN PLOTS		C	CV	DE2	MA2
pH		6.4(.2)	6.2(.1)	7.2(.1)	6.9(.1)
OM	%	5.2(.1)	5.4(.3)	7.8(.3)	14.6(.3)
BD	g/cm^3	1.6(.01)	1.6(.04)	1.3(.02)	1.3(.06)
TOTAL N	%	0.13(.01)	0.13(.01)	0.22(.01)	0.37(.02)
Nitrate N	lbs/a	6.3(6.3)	61(15)	0	0
Ammon. N	lbs/a	4.5(.4)	10.3(1.7)	10.9(.7)	15.1(1.1)
Avail. P	lbs/a	9.8(1.2)	8.2(.8)	53.3(3.7)	205(26)
Avail. K	lbs/a	152(18)	146(13)	291(34)	408(8)
Soluble Salts	mmhos/cm	0.4(.06)	1.5(.06)	2.4(.22)	1.5(.12)
		Pore Water N, April 1995			
Nitrate-N	mg/l	1.3(.1)	1.8(.3)	2.4(.8)	1.1(.03)
Ammon. N	mg/l	<0.1	<0.1	<0.1	<0.1

SOIL MANAGEMENT

drinking water standard of 10 mg/l (Table 1).

Yield was decreased by low soil nitrate levels during the growing season (Table 1 and Fig. 1). This effect was caused by the higher C/N ratios of the composts applied in 1994, resulting in nitrogen tieup in the organic matter decomposition process and unavailability to plant roots.

In 1993, yields were increased by compost application over fertilized controls. Compost C/N ratios were about 10 in 1993. In 1994, yields suffered because of compost applications with higher C/N ratios. In the case of the MSW compost with a ratio of 22, adding fertilizer N up to 180 lbs/acre did not overcome the season-long N immobilization (Fig. 1), compared to fertilized controls.

In addition, incubation for 100 days in the lab of corn plot soil samples field-amended with the compost produced potential mineralizable N values ranging up to 6% of total compost N at low C/N ratios, but negative values (immobilization) were observed for C/N ratios around 25 (MSW co-compost). These results generally correspond to the yield data. Incubation and yield results in 1994 consistently indicated N mineralization values well below 10% total added organic (or compost) N during the growing season.

Soil and soil pore water samples (Table 1) from corn plots likewise confirmed the low concentrations of nitrate-N available to soil water movement and presumably to root uptake also in all but the high rate, sludge compost plot (good yield but pore water nitrate around 20 mg/l in April, 1995).

Recommendation

The low mineralization rates and yields in 1994 compared to 1993 can be attributed to the higher C/N ratio of 22 for the MSW co-compost and the replacement of woodchips by sawdust in the sludge compost. Conversely continued N mineralization after crop harvest or frost has the potential to release excessive nitrate to the environment. So overfertilization with compost N to compensate for mineralization will likely produce elevated nitrate concentrations in off-season soil pore water. Conversely, underfertilization will produce reduced yields. Either management outcome is to be avoided.

Therefore, the following recommendations are made for compost applications in row crop production in central New York State.

Short term;

1. Use composts of C/N ratio less than 15.
2. Calculate agronomic rates based on N assuming 5% total organic N (TKN) release per growing season.
3. To maintain further control over N-based yields, use a combination of fertilizer N and compost N to meet crop needs. For instance, if a crop requires 120 lbs N/acre, calculate for 60 from compost and 60 from fertilizer N. This would be about 20 t/acre of compost depending on N content, with 60 lbs/acre of fertilizer N to be split 20 lbs at planting and 40 lbs sidedressed.
4. Consideration of a winter cover crop to absorb any residual nitrate-N would be a good idea.

Longterm;

1. Monitor metal additions by doing soil testing about every 3-5 years for total cumulative metals levels. For instance, if the cumulative limit is 3 ppm cadmium in a soil, and compost contained 4 ppm and was being applied at rates of 20 t/acre, then about 15 applications could be made before the limit was approached. But the best way to keep track is by direct soil sampling and analysis.

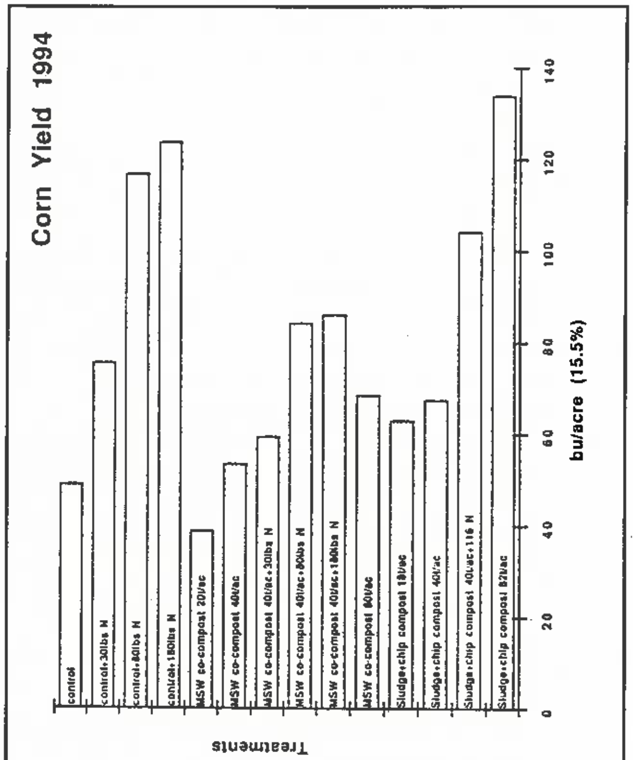


Figure 1. Corn grain yield as affected by compost and fertilizer N aditions. Even at 180 lbs N/a on top of 40 t/a compost, yields were decreased compared to the control plus 180 lbs N/a.

Nutrient Management Strategy

SOIL FERTILITY

Stu Klausner
Soil, Crop and Atmospheric Sciences

INTRODUCTION

Nutrient management involves the development of a planning strategy to ensure that nutrients are used efficiently for the economic production of feed and animal products, and for the protection of water quality. Nutrient management must be viewed in an integrated way. Feeds should be analyzed and rations balanced profitably. Use soil testing to monitor the nutrient levels in the soil and to determine additional needs. The bottom line; don't over feed or over fertilize and implement good soil and water control practices to reduce nutrient loss.

THINGS TO DO

The following components are important for a successful nutrient management plan. For help, refer to the Nutrient Management Workbook available at your Cooperative Extension Office.

Analyze feed and balance rations profitably: About 70% of the nutrients brought into a dairy farm each year is in purchased feed. Therefore, animal nutrient management can have a large impact on the quantity of nutrients that must be cycled on the farm each year. Over feeding is economically and environmentally unsound. Use feed analysis to monitor the quality of home grown and purchased feed and ensure that rations are balanced properly. Monitor animal production efficiency and health to confirm the adequacy of the feeding program.

Animal density: The potential to successfully manage nutrients depends on the amount of cropland available relative to the number of animals and amount of manure produced. An increase in animal numbers requires a corresponding increase in the number of crop acres. Appropriate animal to land ratios prevent excessive applications of nutrients and increases the percentage of the feed requirement that is home grown, thereby, reducing the import of nutrients in purchased feed. (Refer to: Vol 4 No 1 in *What's Cropping Up?* for animal density guidelines.)

Determine quantity of manure produced and collected: The quantity of manure produced and collected should be determined to estimate the quantity that has to be managed in the land application program. The amount collected can be estimated based on the quantity removed from the barn each day, or by calculating the volume in storage.

Analyze manure to determine nutrient content: Analyze samples periodically for their nutrient content. Analyses should be done several times a year at first and periodically once a reasonable estimate of nutrient content is determined. The analysis, at minimum, should include total N, ammonium N, P, K, and dry matter content. The quantity of nutrients collected can be calculated based on the amount of manure collected.

Use a crop rotation and cultural practices that maximize economic feed production: Determine the dry matter requirements of the feeding program. Develop a crop rotation that provides as much of the dry matter requirement as possible. Verify that soil productivity levels can support the rotation and that good soil conservation practices are followed. Improved cultural practices will increase yield and crop quality and reduce the need for purchased feed.

Soil test to determine crop nutrient requirements: Maintain a good soil testing program to monitor the nutrient status of fields and to determine supplemental nutrient requirements.

Estimate nutrient availability in manure: The nutrients in manure cannot be substituted for those in commercial fertilizer on a pound for pound basis. Estimates of the fertilizer replacement value of manure have been derived from field experiments. They can be obtained from your Cooperative Extension Office.

Hydrologic evaluation: Evaluate the hydrologic sensitivity (runoff, leaching, flooding, and erosion potential) of individual fields. Determine the best month(s) to apply manure to reduce the nutrient loss potential.

Manure application: Use manure as the primary source of nutrients. Base the application rate on the availability and crop requirement of the highest priority nutrient. Apply as much as possible during periods of the year that maximize the combination of high crop demand and low nutrient loss potential.

Fertilizer management: Fertilizer should be used only to supplement additional requirements. Be sure that the rate, timing, and method of application is consistent with good management.

(SEE, STRATEGY, PAGE 7)

WEED CONTROL

Early Postemergence Pursuit Applications for Soybeans

Russ Hahn
Soil, Crop and Atmospheric Sciences

Pursuit (imazethapyr) is the first of the imidazolinone herbicides to be registered for field crops in NY State. For 1995, the registration is for soybeans only. Like the sulfonylurea herbicides (Accent, Beacon, Pinnacle, etc.), the imidazolinones are ALS (acetolactate synthase) inhibitors. These herbicides bind with the ALS enzyme and disrupt amino acid synthesis in susceptible plants. These plants will be stunted and chlorotic (yellow) or purple.

Unlike many of the new herbicides, Pursuit has activity against a broad spectrum of grass and broadleaf weeds. Pursuit provides fair to good control of NY's common annual weeds except common ragweed and common lambsquarters. Most perennial weeds, including yellow nutsedge, are not controlled.

Application Flexibility

Pursuit is absorbed by both roots and foliage and is translocated both upward and downward to growing points in plants. As a result, Pursuit may be applied preplant incorporated (PPI), preemergence (PRE), or early postemergence (EPO) for soybeans. EPO applications must include a nonionic surfactant <u>or</u> a crop oil concentrate <u>and</u> a nitrogen based liquid fertilizer (28% N, 32% N, or 10-34-0).

For optimum weed control, EPO applications should be made when weeds are actively growing and before most weeds are 3 inches in height. Pursuit will provide residual control of weeds that may germinate following EPO application. Since Pursuit can be tank-mixed with a variety of postemergence (PO) grass and broadleaf herbicides, it has the potential to serve as the basis for several total PO weed control programs for soybeans.

Ragweed Strategy

An experiment conducted at Aurora (Cayuga Co.) in 1993 compared PO Pursuit applications with standard PRE treatments. Soybeans (Funk's G-3197) were planted June 7 but Pursuit applications were not made until July 4 when the soybeans were in the 3rd trifoliolate leaf stage and most of the weeds were 5 to 6 inches in height rather than the recommended height of 1 to 3 inches. Weed control ratings from selected treatments are shown in Table 1. The PRE standard of 2 pt/A of Dual plus 0.67 lb/A of Sencor DF provided excellent (94-100%) velvetleaf (ABUTH), ragweed (AMBEL), and lambsquarters (CHEAL) control. Pursuit alone and in combination with Reflex or Cobra provided 80-89% velvetleaf control. Pursuit alone controlled only 51% of the ragweed while tank-mixes with the diphenylether herbicides Reflex or Cobra controlled 96 and 99% of the ragweed respectively. While the standard PRE treatment yielded 31 bu/A, soybean yields with the Pursuit treatments were reduced 50% due to the late application.

Pinnacle Combination

Although Reflex or Cobra improved ragweed control, neither improved control of common lambsquarters. An experiment conducted at Aurora in 1994 demonstrated the importance of EPO application and the value of tank-mixing Pinnacle with Pursuit to improve lambsquarters control. Soybeans

Table 1. Weed control ratings with postemergence Pursuit and standard preemergence treatments at Aurora in 1993.

Herbicides	Amt/A	ABUTH	AMBEL	CHEAL
			-------------%-------------	
Dual	2 pt	94	100	100
+ Sencor	.67 lb			
Pursuit*	4 oz	83	51	20
Pursuit	4 oz	80	96	22
+ Reflex*	10 oz			
Pursuit	4 oz	89	99	15
+ Cobra*	6 oz			
LSD (0.05)		20	23	13

* Included nonionic surfactant + 1% 28% N.

(Funk's G-3197) were planted May 31 and Pursuit applications made June 22 when soybeans were in the 2nd trifoliolate leaf stage and weeds were 2 to 3 inches in height. Results in Table 2 show that Pursuit alone and with Cobra provided only 46 and 35% lambsquarters control respectively, while the combination of Pursuit plus Pinnacle controlled 96%. Although velvetleaf control was excellent with all treatments shown, Cobra reduced green foxtail (SETVI) control from 95 to 80%. Soybean yields were excellent (55-59 bu/A) with all three treatments and were not significantly different from standard PRE treatments in an adjacent experiment.

These and other results from experiments conducted each year since 1987 suggest that Pursuit or Pursuit combinations may provide cost effective EPO soybean weed control unless yellow nutsedge requires a soil-applied herbicide such as Dual. The Pursuit label does not include a three-way tank mix with Reflex or Cobra and Pinnacle and crop safety of this mixture is unknown. It will be included in 1995 trials.

Table 2. Weed control ratings with postemergence Pursuit applications in 1994.

Herbicides*	Amt/A	ABUTH	CHEAL	SETVI
			%	
Pursuit	4.0 oz	98	46	95
Pursuit	4.0 oz	97	35	80
+ Cobra	4.0 oz			
Pursuit	4.0 oz	100	96	95
+ Pinnacle	1/8 oz			
LSD (0.05)		2	20	3

* Included nonionic surfactant + 1% 28% N.

(FROM STRATEGY, PAGE 5)

Storage requirement: Storage may be helpful to improve management. However, a particular manure handling system does not in itself improve nutrient recycling; management does. Storage provides the potential to manage efficiently through proper timing of application. However, if adverse weather conditions prevail when the storage must be emptied, then a storage system may be less advantageous than daily spreading. Daily spreading on the other hand may be managed more efficiently if short term storage is provided during bad weather.

Soil and water conservation: Work closely with the Natural Resource Conservation Service and your Soil Water Conservation District to ensure that adequate soil and water control practices are in place.

Management: Management is the key to a successful nutrient management plan. Over feeding or over fertilization should not be used to compensate for weaknesses in management. Example: don't over apply fertilizer in order to erase problems due to non-uniform manure spreading patterns or because the rate and nutrient content of the manure was unknown. The solution would be to know the nutrient content of manure, calibrate the spreader, spread uniformly, and apply the right amount of fertilizer.

Because we don't live in perfect world, keep a watchful eye on soil test levels, manure analyses, rates and uniformity of application, and the productivity level of fields. Continual monitoring and periodic adjustments are vital to the success of a nutrient management plan.

SUMMARY

Develop a plan to ensure that nutrients are managed for the economic production of feedand animal products and for the protection of water quality.

- analyze feeds and balance rations profitably.
- soil test to determine nutrient requirements.
- use manure as the major source of nutrients.
- don't over feed.
- don't over fertilize.

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
June 29	Aurora Farm Field Day, Aurora Research Farm, Aurora, NY
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. 24,25,26	Field Crop Dealer Meetings, Albany, Waterloo, and Batavia
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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