Northeastern Branch of Crop, Soil and Agronomy Societies of America

Abstract Bulletin

June 27-30, 2010

2010 Annual Meeting
Cornell University, Ithaca, New York

Plenary session:

1. **Global Agricultural Transitions in the Coming Generation: Commercial, Environmental and Humanitarian Challenges.** Chris Barrett, Department of Applied Economics and Management, Cornell University, Ithaca NY 14853.
2. **Dairy and Food Production in the Northeastern U.S. – Sustainability, Efficiency and Challenges.** Mike E. Van Amburgh and Tom R. Overton, Department of Animal Science, Cornell University, Ithaca, NY 14853.
3. **Integrating Crop and Herd Management on Modern Dairy Farms – Part 1.** Charles J. Sniffen, Fencrest, LLC. Holderness, NH 03245.
4. **Integrating Crop and Herd Management on Modern Dairy Farms – Part 2.** Everett D. Thomas, Oak Point Agronomics, Hammond, NY 13646.

Oral student presentations:

5. **Reducing Tillage in an Organic Vegetable System: In-Row Weed Control and Fertility Management.** [1]Sara Rostampour, [1]Anusuya Rangarajan, [2]Charles Mohler, [2]Antonio DiTommaso, [1]Department of Horticulture, [2]Department of Crop and Soil Sciences, Cornell University, Ithaca NY 14853.
6. **Potassium Fertilization Affects Psychrophilic Pathogen Development in Annual Bluegrass.** David R. Moody and Frank Rossi, Department of Horticulture, Cornell University, Ithaca NY 14853.
7. **Effects of Late Season N/PGR Applications on Carbohydrate Balance and Spring Green up of Cool Season Turfgrasses.** Chase Rogan and Max Schlossberg, The Pennsylvania State University.
8. **Using a Spatial Model for Estimating the Critical Planting Date for Rye Cover Crop in Massachusetts.** Ali Farsad, Timothy Ramdhir, Stephen J. Herbert, Masoud Hashemi, University of Massachusetts-Amherst.
9. **Shallow Incorporation of Manure in Reduced Tillage Systems Conserves Residue and Nitrogen.** Anne M. Place[1], Quirine M. Ketterings[1], Greg Godwin[1], Peter Barney[2], Joseph R. Lawrence[3], Brian Aldrich[4], Tom Kilcer[5], Karl Czymmek[1] and Brent Gloy[6], [1]Department of Animal Science, Cornell University, [2]Barney Agronomic Services, [3]Cornell Cooperative Extension of Lewis County, [4]Cornell Cooperative Extension of Cayuga County, [5]Advanced Ag Systems Research, Education, Consulting, [6]Department of Applied Economics and Management, Cornell University.

Posters:

10. **Nitrogen Dynamics after Cover Crop Incorporation.** Emmaline A. Long, Quirine M. Ketterings, and Sanjay Gami, Department of Animal Science, Cornell University, Ithaca NY 14853.
11. **Impact of Clover Incorporation and Ammonium Nitrate Sidedressing on Ammonium, Nitrate and Illinois Soil Nitrogen Test Dynamics over Time.** Greg

Godwin[1], Quirine M. Ketterings[1], Charles L. Mohler[2], Brian Caldwell[2], and Karl J. Czymmek[1], [1]Department of Animal Science and [2] Department of Crop and Soil Sciences, Cornell University, Ithaca NY 14853.

12. **Effect of Sampling Protocol on Corn Stalk Nitrate Test Results.** Eun Hong, Quirine M Ketterings, Sarah Wharton, Kate Orloski, Greg Godwin, and Sanjay Gami, Department of Animal Science, Cornell University, Ithaca NY 14853.
13. **Nitrogen Balances for New York State: Implications for Manure and Fertilizer Management,** Sheryl N. Swink, Quirine M. Ketterings, Larry E. Chase, Karl J. Czymmek, and Mike Van Amburgh, Department of Animal Science, Cornell University, Ithaca NY 14853.
14. **Evaluation of the K Saturation and Soil Test K Approaches for Their Effectiveness in Predicting a Yield Response to K Addition,** Chang Lian[1], Quirine M. Ketterings[1], Karl J. Czymmek[1], Greg Godwin[1], Jerry Cherney[2], [1]Department of Animal Science and [2]Department of Crop and Soil Sciences, Cornell University, Ithaca NY 14853.
15. **Impact of N Fertilizer Sources on Corn Silage Yield and Quality.** Greg Godwin[1], Quirine M. Ketterings[1], Tom Kilcer[2], Karl J. Czymmek[1], [1]Department of Animal Science, Cornell University, Ithaca, NY 14853, and [2]Advanced Ag Systems Research, Education, Consulting LCC, Kinderhook, NY 12106.
16. **Estimating Nutrient Losses from Tile-Drained Fields in Northern New York.** Eric O. Young[1], Stephen Kramer[1], Larry Goehring[2], and Quirine M. Ketterings[3], [1]William H. Miner Agricultural Research Institute, Chazy NY, [2]Department of Biological and Agricultural Engineering, Cornell University, Ithaca, NY, [3]Department of Animal Science, Cornell University, Ithaca, NY 14853.
17. **Geospatial Assessments of Cropping Systems and Farmland Assemblages in New England.** Sherri L. DeFauw and C. Wayne Honeycutt, USDA, ARS, NAA, New England Plant, Soil, and Water Laboratory, Orono, ME 04469.
18. **Perennial Grass Management Influences Combustion Characteristics,** Jerry H. Cherney[1], Quirine M. Ketterings[2], Michael H. Davis[3], Debbie J.R. Cherney[2], [1]Department of Crop and Soil Sciences, [2]Department of Animal Science, Cornell University, and [3]Willsboro Research Farm.
19. **Can Soil Pore Water Electrical Conductivity Data Logging Sensors be Used to Monitor Cover Crop Decomposition and Nitrate Release *In Situ*?** Charles White[1], Yvonne Lawley[2], Ray Well[2],[1]Department of Crop and Soil Science, The Pennsylvania State University, and [2]Department of Environmental Science and Technology, University of Maryland.
20. **Diversifying Monoculture Crop Through Incorporating Prairie Buffer Strips.** Sarah Hirsh and Matt Liebman, Iowa State University.
21. **Comparison of Tall Fescue Cultivars for Yield and Quality of Spring Growth,** Debbie J.R. Cherney[1], Jerry H. Cherney[2] and D. Parsons[3], [1]Department of Animal Science, [2]Department of Crop and Soil Sciences, Cornell University, Ithaca, NY 14853 and [3]University of Tasmania.
22. **Correlations among Forage Quality, Yield, and Maturity for Alfalfa in Central New York,** Julie Hansen, J. Crawford, Don Viands, Department of Plant Breeding and Genetics, Cornell University, Ithaca, NY 14853.

23. **Optimized work-flow for assaying tomato fruit quality: Vitamin C, titratable acids, brix and lycopene.** Joanne A. Labate, Susan M. Sheffer and Larry D. Robertson, Plant Genetic Resources Unit, USDA, ARS, Geneva NY 14456.
24. **Effective Foliar Treatment of Manganese Deficiency in Soybean,** Joseph Heckman, Rutgers University.
25. **Yield and Composition of Bio-Char from Pyrolysis of Sorghum at Varied Temperature.** Don Vietor, Sergio Capareda, Jay Wise, Derek Husmoen, Ronnie Schnell, Tony Provin, and Clyde Munster, Texas AgriLife Research, College Station, TX.
26. **Preharvest Neutral Detergent Fiber Concentration of Temperate Grasses as Influenced by Stubble Height.** Keenan C. McRoberts[1], Davin Parsons[2], and Jerry H. Cherney[1], [1]Cornell University, Ithaca, NY, [2]University of Tasmania.
27. **Manure Nutrient Variability Across a Spreading Event, Years, and Multiple Dairy Operations.** Patty Ristow, Sarah Moss, Quirine M. Ketterings, Tim Shepherd, Karl Czymmek, Department of Animal Science, Cornell University, Ithaca NY 14853.
28. **Nitrogen Dynamics Following Surface-Application of Enhanced Efficiency Fertilizers.** Jeffrey K. Williard, Quirine M. Ketterings, Sanjay K. Gami, Department of Animal Science, Cornell University, Ithaca NY 14853.
29. **Web-based Course for Aspiring Northeast Region Certified Crop Advisors,** Quirine M. Ketterings[1], Larissa Smith[2], Margaret Dunn[1], Jeff Williard[1], Patty Ristow[1], [1]Department of Animal Science, [2]Department of Crop and Soil Sciences, Cornell University, Ithaca NY 14853.
30. **Evaluation of Nitrogen Management of Corn Using the Illinois Soil Nitrogen Test and Corn Stalk Nitrate Test.** Sanjay K. Gami, Quirine M. Ketterings, Eun Hong and Patty Ristow, Department of Animal Science, Cornell University, Ithaca NY 14853.
31. **Dairy, Livestock and Cash Grain Farmer Perceptions of the Value of Manure.** Julia Knight[1], Patty Ristow[1], Graham Swanepoel[1], Karl Czymmek[1], Brent Gloy[2], and Quirine M. Ketterings[1], [1]Department of Animal Science, [2]Department of Applied Economics and Management, Cornell University.
32. **Using Whole Farm Mass Balances as a Management Tool on New York State Dairy Farms.** Caroline Rasmussen, Quirine M. Ketterings, Larry Chase, Karl Czymmek, Patty Ristow, Department of Animal Science, Cornell University, Ithaca NY 14853.
33. **Cover Crop Practices and Usage among Dairy Farmers in Washington County, New York.** Joanne Chickering[1,2], Emmaline Long[1], Quirine Ketterings[1], Aaron Gabriel[2], [1]Department of Animal Science, Cornell University, [2]Cornell Cooperative Extension Washington County.

Oral presentations - Crops:

34. **Yield, Quality and Time of Harvest of Tall Wheatgrass for Biomass Energy.** Paul R. Salon[1], Tibor Horvath[1], Martin van der Grinten[1] and Hilary Mayton[2], USDA-NRCS[1] and [2]Cornell University.

35. **Planting Density and Plant Growth Regulators Impact on Castor Bio-oil Production in the Northeast.** Thomas Kilcer, Advanced Ag Systems LLC, Kinderhook, NY 12106.
36. **Mustard Cover Crop and Nitrogen Influence on Potato Yield and Quality.** John Jemison[1] and Peter Sexton[2], [1]University of Maine; [2]South Dakota State University.
37. **Impact of Date of Planting Winter Triticale for Dairy Forage.** Thomas Kilcer, Advanced Ag Systems LLC, Kinderhook, NY 12106.
38. **A Study to Look at Practices Aimed at Reducing Mechanical Cultivation in Organic Corn.** Janice Degni, Cornell Cooperative Extension.
39. **Effects of Nitrogen Deficiency on Organic Nitrogen Metabolism in Leaves and Roots of Creeping Bentgrass.** Zhongchun Jiang[1], Chenping Xu[2] and Bingru Huang[2], [1]State Univ. of New York, Cobleskill, NY 12043, [2]Rutgers Univ., New Brunswick, NJ 08901.
40. **Understanding the Physiology And Mechanisms of Seed Dormancy in Switchgrass (*Panicum virgatum* L.).** Denise V. Duclos[1], Dennis Ray[2], and Alan G. Taylor[1], [1]Department of Horticultural Sciences, New York State Agricultural Experiment Station, Cornell University, Geneva, NY 14456-0462, USA, [2]Division of Horticultural and Crop Sciences, School of Plant Sciences, University of Arizona, Tucson, AZ 85721, USA.
41. **Precision Irrigation to Improve Water Use Efficiency.** S.E. White, J. Adkins, and C. Whaley, University of Delaware..
42. **Adaptive Management of Winter Cover Crops Using Remote Sensing and Data Sharing Strategies.** W. Dean Hively[1], G.W. McCarty[2], J. Keppler[3], M. Lang[4], and A. Sadeghi[4], Maryland Department of Agriculture, USGS Eastern Geographic Science Center, [2]USDA-ARS Hydrology and Remote Sensing Laboratory, [3]Office of Resource Conservation, and [4]USDA-ARS HRSL.
43. **Heavy Fertilization with Compost and Manure Can Cause Weed Problems.** Charles L. Mohler[1], Thomas Björkman[2], Klaas Martens[3], Brian Caldwell[1], Quirine M. Ketterings[4], Antonio DiTommaso[1],[1]Department of Crop and Soil Science, Cornell University, Ithaca NY 14853, [2]Department of Horticultural Science, Geneva NY, [3]Lakeview Organic Grains, Penn Yan, [4]Department of Animal Science, Cornell University, Ithaca NY 14853.
44. **The Cornell Organic Grain Cropping Systems Experiment: Nutrients, Yields and Net Returns through Transition and Beyond.** Charles L. Mohler[1], Brian Caldwell[1], and Quirine M. Ketterings[2],[1]Department of Crop and Soil Sciences, [2]Department of Animal Science, Cornell University, Ithaca NY 14853.

Oral presentations – Soils/Farms:

45. **Influence of Soil Properties on Riparian Soil Phosphorus Availability.** Eric O. Young[1], Donald S. Ross[2], Caroline Alves[3], and Thomas Villars[4], [1]William H. Miner Agricultural Research Institute, Chazy, NY, [2]Department of Plant and Soil Science, University of Vermont, Burlington, VT, [3]United States Department of Agriculture-Natural Resources Conservation Service, Williston, VT, [4]United States Department of Agriculture-Natural Resources Conservation Service, White River Jct., VT.

46. **Arsenic and Lead Uptake by Vegetable Crops from Old Orchard Soils.** M.B. McBride[1], L. Kalbacker[1] and L. Baker[2], [1]Department of Crop and Soil Sciences, Cornell University, Ithaca, NY 14853, [2]Soil and Land Resources Division, University of Idaho.
47. **Managing Fertilizer to Reduce Nitrous Oxide Emission in Eastern Canada.** Tom W. Bruulsema, International Plant Nutrition Institute, Guelph, Ontario, Canada.
48. **Reducing Phosphorus Runoff from Small Livestock Farms into Missisquoi Bay.** Sally A. Flis[1] and Jeffery E. Carter[2], – [1]Bourdeaus' and Bushey, Inc., and [2]UVM Extension.
49. **Potassium (K) Fertilization of Alfalfa-Grass: How Much do we Really Need?** Karl Czymmek[1], Quirine Ketterings[1], Greg Godwin[1], Chang Lian[1], Jerry Cherney[2], [1]Department of Animal Science, [2]Department of Crop and Soil Sciences, Cornell University, Ithaca, NY 14853.
50. **Nutrient Management Planning for Small Farms in the New York City Watershed.** Dale Dewing, Cornell Cooperative Extension of Delaware County.
51. **Chesapeake Bay Issues: The Junction of Science and Policy.** Dave Hansen, University of Delaware.
52. **Managing Nutrients on Dairy Farms Through Feed Management.** Paul E. Cerosaletti, Dale R. Dewing and April W. Lucas, Extension Educators, Cornell Cooperative Extension of Delaware County.
53. **Evaluation of Farm Performance Indicators of Three New York Dairies as Predictors for Farm Nutrient Balances over Time.** Patty Ristow[1], Quirine M. Ketterings[1], Caroline Rasmussen[1], Karl Czymmek[1], Mike Van Amburgh[1], Larry Chase[1], [1]Department of Animal Science, Cornell University.
54. **Sulfur Needs of Alfalfa; Tools for Sulfur Management.** Quirine Ketterings[1], Jerry Cherney[2], Greg Godwin[1], Sanjay Gami[1], Debbie Cherney[1], Karl Czymmek[1], [1]Department of Animal Science, [2]Department of Crop and Soil Sciences, Cornell University.
55. **Energy Crop Anaerobic Digestion.** Curt A. Gooch, P.E., Cornell University, PRO-DAIRY Program
56. **Manure Value/Cost Calculator.** Caroline Rasmussen[1], Patty Ristow[1], Margaret Dunn[1], Brent Gloy[2], Wayne Knoblauch[2], Karl Czymmek[1], Tim Shepherd[1], Quirine M. Ketterings[1.] [1]Department of Animal Science, [2]Department of Applied Economics and Management, Cornell University

Plenary Session

Challenges and Opportunities for Sustainable Food Production in 2040

1. Global Agricultural Transitions in the Coming Generation: Commercial, Environmental and Humanitarian Challenges

Chris Barrett
Department of Applied Economics and Management, Cornell University, Ithaca NY 14853

This talk reviews broad patterns of changing global agricultural demand and supply, documenting recent trends and the best available projections over the coming 20-40 years. Continued growth in incomes and population, especially in the currently low-and-middle-income world, will fuel continued demand expansion outside the United States. Meanwhile, increasing scarcity and degradation of arable land and water limit supply expansion under existing technologies and yield growth has been slowing over the past decade. These broad structural patterns will likely result in continued price volatility and occasional serious price spikes in coming decades. They should also, however, induce accelerated investment in technological advances in agriculture, especially in emerging markets, and freer global trade in agricultural products. Along with climate change, these patterns bode well, on net, for commercial agriculture in the northeastern United States but pose major commercial, environmental and humanitarian challenges for the world.

Plenary Session led by Greg Albrecht, New York State Department of Agriculture and Markets

2. Dairy and Food Production in the Northeastern U.S. – Sustainability, Efficiency and Challenges

Mike E. Van Amburgh and Tom R. Overton
Department of Animal Science, Cornell University, Ithaca, NY 14853

Animal-source food production and specifically dairy is under increasing consumer and public scrutiny due to implied or perceived negative impacts of current production systems on the environment and to some degree food quality and human health. As an industry we are focused on the concept of “sustainability” but struggle to determine what that means in the context of food production, environmental impact, affordable food, animal welfare, and human health. The word or concept of sustainability is a considered a “wicked problem” because it is a word or concept without a true definition - everyone has their own interpretation, similar to a word like democracy. The industry itself is mired in an identity crisis since it recognizes that differentiating milk based on perceived benefits allows it to find increased marginal profit; however, this may risk marginalizing the commodity and a portion of the industry. This leads to further discussions about the impacts and animal and human health implications of extensive versus intensive agriculture. Although extensive agricultural production systems have been idealized, intensive agriculture leads to more efficient use of resources. Keys to sustainability of food systems all involve increased efficiencies: milk per cow, milk per hectare, milk per unit of intake and tons per hectare. We will review several factors related to the sustainability of food and specifically dairy production and discuss the outcome of a recently held conference focused on sustainability of the dairy industry.

3. Integrating Crop and Herd Management on Modern Dairy Farms – Part 1

Charles J. Sniffen, Fencrest, LLC.
Holderness, NH 03245

The management of modern dairies is a complex task in today's dairy economy. The complexity of this management increases with the size of the dairy. One of the more complex parts of the management challenges is the management of the crop operation which includes, in today's environment varying degrees of farm grown forages and purchased forages. The management of the crops has taken on a greater degree of complexity with the introduction of nutrient and air quality regulations. Combine this with changing needs of the herd in terms of not only different groups of animals on the farm, but also whether the herd size is being held constant or is in an expansion mode. We can categorize herds into 3 forage categories: More than adequate land to provide forage, in an average year, in excess of the forage needs of the herd; enough land just to meet the forage needs of the herd in an average year; inadequate land to provide forage in an average year. I will deal with the first category in my discussion. We need to combine an assessment of animal inventory for each class of animal on the farm with an understanding of the requirements of that group. There are several groups of animals on the farm with unique nutrient and forage requirements: transition post wean, post wean to puberty, puberty to bred, bred to close up, early dry, close up, fresh, high, low, lactating heifer group. Transition heifers and heifers up through puberty need a high quality grass. Heifers from weaning to bred, intermediate quality grass. The bred heifers need an average quality grass. Early dry and close up need a poor to average quality grass. Fresh cows need an average quality grass with some conventional corn silage. High group cows need high quality forages with high NDF digestibility. This can be in the form of BMR corn, alfalfa or very high quality grasses. Late lactation cows need average to good quality grasses in combination with conventional corn silage with reasonable digestibility parameters of digestibility. These requirements dictate a crop management program of greater complexity. It also dictates the development of a good storage system that will allow forage segregation by quality. With proper identification of groups, inventory of groups, a reasonable estimate of crop needs can be made. Our goal is to maximize forage in the rations of the herd. This will result in greater production efficiency and improved animal health.

4. Integrating Crop and Herd Management on Modern Dairy Farms – Part 2

Everett D. Thomas, Oak Point Agronomics,
Hammond, NY 13646

This presentation uses as a case study the dairy-crop enterprise at the William H. Miner Agricultural Research Institute in Chazy, NY, beginning with the Institute assuming responsibility for the farm in 1979 and as changes occurred with new leadership. During the 1980s the dairy was operated primarily a commercial farm, with an educational focus but relatively little associated research. Beginning in the 1990s, though, the focus gradually changed as applied research became a significant part of the farm operation, with research income in 2009 exceeding $500,000. As herd size grew from less than 100 milk cows to the current 330, milk production increased considerably and is currently over 31,000 lbs/cow. Some keys to success: 1. Test forages as they are ensiled, not for ration balancing but to approximate forage quality for planning purposes. 2. Chop weather-damaged forage back onto the field if quality is so compromised that it will have a significant negative impact on herd performance. 3. Carefully plan forage storage, with the goal of having each silo completely fed out before a new crop is ensiled. 4. Don't be defensive when things go wrong, as they most assuredly will from time to time. 5. Don't hesitate to listen to ideas and suggestions from people not directly involved in the daily management of the farm. The key to success isn't any one big thing, but a lot of little things done right.

Farmer Panel led by Karl Czymmek, PRODAIRY, Cornell University

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McDonald Farm
(Seneca County)
Peter McDonald, Romulus, NY

McDonald Farm (http://pasturepride.com) is a 220 acre pasture-based, multi species, multi-generational small family farming venture located in the heart of the Finger Lakes Region of Upstate NY. Owned and operated by the Peter McDonald family, McDonald Farm is developing into a successful model for fulfilling relationships between soil, animals and people through a farming enterprise dedicated to restorative agricultural practices for clean food production.

Spruce Haven Farm
(Cayuga County)
Doug Young, Union Spring, NY

Located in Union Springs, NY, in the Fingerlakes region, the farm's main focus is fluid milk production (http://www.sprucehavenfarmllc.com/). The business has also diversified to create additional income through Research, which is led by Dr. Jim Nocek, and Genetics which is managed by Sam Potter. Spruce Haven Farm, LLC strives to provide a reasonable living for the families it supports, while maintaining a symbiotic relationship with the land and cattle they care for.

Hemdale Farms and Greenhouses
(Ontario County)
Dale Hemminger, Clifton NY

Dale's 2,800 acre upstate NY farm, Hemdale Farms and Greenhouses (http://www.edf.org/article.cfm?contentID=6157), has been managed to provide environmental benefits since the beginning. Dale credits his farming-philosophy to his late father, Ralph, a natural steward of the land. Ralph and his wife Elsie started the farm in 1953 and Dale joined in managing the operation in 1976. Hemdale Farms now consists of 700 dairy cows (milking robots), 1,500 acres of vegetables - 300 acres of which are organic, 1,300 acres of forage crops, and a greenhouse that grows vegetable seedlings for local grower use.

Student Oral Presentations

5. Reducing Tillage in an Organic Vegetable System: In-Row Weed Control and Fertility Management

[1]Sara Rostampour, [1]Anusuya Rangarajan, [2]Charles Mohler, [2]Antonio DiTommaso
[1]Department of Horticulture, [2]Department of Crop and Soil Sciences, Cornell University, Ithaca NY 14853

Organic systems depend on intensive tillage for weed management, yet interest in conservation tillage methods is expanding in response to concerns regarding soil quality and environmental health. Deep zone tillage is one method that minimizes the width of soil disturbance to the planting row while providing sufficient disturbance to increase drainage and aeration and decrease compaction. This research addresses two constraints to an organic reduced tillage vegetable system: in-row weed control and fertility management. Two cover crop mixes, hairy vetch-rye or oats-peas were sown on two different dates at two different rates. Oat-pea cover crops were winter killed (leaving minimal residue) and hairy vetch-rye plots were flail mowed. Plots were then deep zone tilled, without incorporating cover crop biomass. Peppers were transplanted, and cover crop mulch in half the hairy vetch-rye plots was moved in-row to concentrate the biomass, providing in-row weed control. Time required for cultivation and handweeding was recorded for economic analysis. Weed counts and biomasses, pepper plant and fruit size, soil temperature, and soil N were monitored over the season. All hairy vetch-rye plots had less mid-season soil soluble N than oat-pea plots; potentially mineralizable N did not differ at any time. Planting cover crops earlier increased cover crop biomass the following spring but increasing seeding rates did not increase biomass. In-row mulch decreased mid-season weed biomass and pepper plant size but did not decrease weed biomass at the end of the season. Despite the difference in pepper plant sizes throughout the season, total marketable fruit yields did not differ significantly between treatments.

6. Potassium Fertilization Affects Psychrophilic Pathogen Development in Annual Bluegrass

David R. Moody and Frank Rossi
Department of Horticulture, Cornell University, Ithaca NY 14853

Annual bluegrass [*Poa annua* var. reptans (Hauskn) Timm.] is a ubiquitous cool-season turfgrass that is susceptible to the psychrophilic fungi *Typhula incarnata* Lasch (TI) and *Microdochium nivale* Fr. (MN). Anecdotally, K fertilization is implicated in conferring resistance/ susceptibility to TI and MN, yet few studies examine this issue. In a greenhouse, forty annual bluegrass seeds were sown into 120 – 30 x 10 cm diam. sand filled columns. Nitrogen (0.5 g m^2), K (0.5 g m^2), and other plant essential nutrients (PENS) were applied weekly for 90 d. Following establishment, application rates of N and PENS remained constant, yet 5 different K treatments (0, 0.25, 0.5, 2, 3 g m^2 $7d^{-1}$) were imposed for 90 d. Columns were then moved to a refrigerated room, maintained under a photosynthetically active radiation flux of ~300 µmol m^{-2} s^{-1}, and day/night air temperature was incrementally lowered every 7d over 28 d (10/4°C, 4/-2°C, 2/-4°C, -2/-6°C). Plants were then buried in 10 cm snow and kept under darkness at -4°C for 28d. After thawing at 2°C, 8 replicates of each K TRT were inoculated with a 10 mm agar disc taken from TI, MN, or sterile cultures. Columns were incubated at 2°C (40 d) then 4°C (45 d) under periodic misting, photographed every 10 d, and evaluated for % necrotic turf. Survival analysis of days to 50% necrosis (Day_{50}) was used to quantify disease progression. Potassium treatment significantly affected Day_{50} in TI but not MN inoculated turf. Specifically, Day_{50} of TI inoculated turf was inversely proportional to K rate and ranged from 78.5 (0 g K m^2 $7d^{-1}$) to 60 (3 g K m^2 $7d^{-1}$). While specific physiological mechanisms underlying these observations are still being explored, these data suggest that K fertilization may impact the progression of psychrophilic fungi infection.

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7. Effects of Late Season N/PGR Applications on Carbohydrate Balance and Spring Green up of Cool Season Turfgrasses

Chase Rogan and Max Schlossberg
The Pennsylvania State University

Winter injuries of creeping bentgrass (Agrostis stolonifera L.)/annual bluegrass (Poa annua L.) cohabited golf course putting greens are common across the Northern United States and Canada. A field experiment was initiated in Sept. 2009 to determine optimal timing of late season N applications, as well as the interactive and/or main effects of N rate and plant growth regulator treatments on winter survival and spring vigor of putting green systems intensively-managed within the Pennsylvania State University Joseph Valentine Turfgrass Research Center in University Park, PA. The effects of N, trinexapac-ethyl (TE), and timing of Fall applications on turfgrass canopy density (green normalized differential vegetative index; GNDVI) and vigor (clipping yield; kg ha-1) were measured in late-March and early-April of 2010. Spring GNDVI was directly related to Fall N rate (30 vs. 60 kg ha-1). Furthermore, TE (0.088 kg ha-1) resulted in significantly increased GNDVI as compared to treatments devoid of TE. However, no interactions were observed among the various N and TE treatments. Although four distinctly-timed treatments were made in Fall, and enhanced N uptake corresponded to earlier application dates; no significant trend in Spring canopy density resulted.

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8. Using a Spatial Model for Estimating the Critical Planting Date for Rye Cover Crop in Massachusetts

Ali Farsad, Timothy Ramdhir, Stephen J. Herbert, Masoud Hashemi.
University of Massachusetts-Amherst

Time of planting plays a critical role in nutrient recovery by winter rye cover crop. A few days delay in planting can significantly decrease cover crop performance. Our goal was to determine suitable cover crop planting dates for Massachusetts using a GDD-based model. Winter rye cover crop was planted in 6 planting dates in fall from mid August to early October at weekly intervals during 2004 through 2009. A model was developed to estimate cover crop biomass and N uptake for all locations in Massachusetts based on samples taken during fall, winter and spring and long term weather data from 14 weather stations. The model divided Massachusetts into five Zones and in each Zone it suggested a critical planting date for cover crop. Delay from critical planting date will affect cover crop growth in fall and therefore decrease potential N recovery dramatically. Suggested critical planting dates for northwest regions of Massachusetts (Zone1 and Zone2) may not be applicable since by that time (third to fourth week of August) corn still is not ready to harvest. Critical planting dates for central parts of the State (Zone3 and Zone4) are from first to second week of September. Growers in these regions should consider alternative managements such as selecting shorter-season corn hybrids so they meet the suggested critical planting date in order to achieve maximum nutrient recovery by winter rye cover crop. In Eastern areas of Massachusetts (Zone 5) critical planting date is the third week of September. Therefore there is enough time for planting winter rye efficiently. By evaluating the effect of planting date on rye growth and nitrogen accumulation throughout the State, this model provides a powerful decision making tool for researchers and farmers.

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9. Shallow Incorporation of Manure in Reduced Tillage Systems Conserves Residue and Nitrogen

Anne M. Place[1], Quirine M. Ketterings[1*], Greg Godwin[1], Peter Barney[2], Joseph R. Lawrence[3], Brian Aldrich[4], Tom Kilcer[5], Karl Czymmek[1] and Brent Gloy[6]
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Determining effective manure management options that are compatible with reduced-tillage corn (*Zea mays* L.) systems is important for reducing nutrient runoff and nitrogen (N)-volatilization risk. In 2008-2009, eight New York State dairy farms participated in a two year on-farm trial to test the hypothesis that shallow incorporation (aerator) of spring-applied manure is an effective reduced tillage option for reducing soil disturbance, conserving N, and maintaining yields comparable to those obtained with more aggressive (chisel) incorporation of manure. The eight fields selected for this trial ranged from first to third year corn production, and had varying manure histories. All trials were conducted using a randomized complete block design (4 replications) comparing surface application of manure (control), shallow incorporation of manure and chisel incorporation of manure, with no more than 34 kg N ha^{-1} of N starter fertilizer used in addition to manure application (51 Mg ha^{-1} – 112 Mg ha^{-1}). Shallow incorporation of manure significantly reduced soil disturbance and retained, on average, 30% more surface residue cover than chisel incorporation. Nitrogen conservation was similar for both incorporation methods, with chisel incorporation conserving slightly more N at three of 16 site-years only. Across all sites and years, incorporation increased silage dry matter yields by 0.45 Mg ha^{-1} and there were no yield differences between the two incorporation methods. We conclude that shallow incorporation of spring-applied manure is a suitable option for conserving N and maintaining greater surface residue coverage without compromising on yield.

10. Nitrogen Dynamics after Cover Crop Incorporation

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Cover crops are increasingly incorporated into crop rotations of dairy and cash grain farms to reduce erosion and nitrate leaching, increase soil carbon (C), and supply nitrogen (N). Research is needed to better quantify N availability from cover crops so that N fertilizer rates can be adjusted. The objectives of this study were to determine the effect of cover crop C:N ratio on: (1) ammonium and nitrate dynamics, and (2) Illinois Soil Nitrogen Test (ISNT-N) as a predictor of soil N supply potential. In study one, rye was sampled over a growing season to determine changes in C:N ratio. Study two was a 13-wk incubation study in which 0.3 g of total N was added to 100 g of soil using five plant materials with C:N ratios ranging from 9 to 48. Soil samples were analyzed for ammonium-N, nitrate-N and ISNT-N. Study one indicated an increase in C:N ratio of rye from 14 (March 31) to 52 (July 24). To obtain material with a C:N ratio of 20 or less, the rye had to be terminated before mid April. Results of study two showed materials with C:N ratios of 21 and 48 immobilized nitrate for 10 and 13 weeks, respectively. Crops with lower C:N ratios caused nitrate release within a week after incorporation, with the greatest N release peaks for the lowest C:N material. These results indicate that materials with C:N ratios >20 are not likely to contribute N to a current year crop but can immobilize end-of-season nitrate. The ISNT-N was impacted by ammonium release following incorporation of the material with a C:N ratio of 9 only, indicating that sampling for ISNT is impacted when low C:N ratio materials are incorporated only. In the latter case, sampling for ISNT should be delayed for 4-5 weeks after cover crop incorporation.

11. Impact of Clover Incorporation and Ammonium Nitrate Sidedressing on Ammonium, Nitrate and Illinois Soil Nitrogen Test Dynamics over Time

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The Illinois Soil Nitrogen Test (ISNT) is a soil organic N test that has been evaluated for use in New York corn (*Zea mays* L.) systems. When used in conjunction with loss-on-ignition (LOI) organic matter the ISNT is an accurate predictor of corn N responsiveness. Earlier work showed this accuracy can be reduced if samples are taken within 5 weeks of sod plowdown or manure application, but it is unknown how cover crop termination or fertilizer addition impact the ISNT. This study examined the influence of red clover (*Trifolium pretense* L.) plowdown in an organic system and sidedressing of ammonium nitrate (AN) in a conventional system on ISNT results. Both systems had a soybean-spelt-corn rotation, with clover following spelt in the organic systems. Soil samples (20 cm depth) were taken before and after primary tillage and weekly thereafter for eight weeks. Soil samples were analyzed for ISNT-N and 2 *N* KCl extractable nitrate + nitrite and ammonium. Clover incorporation increased soil nitrate-N levels which peaked in week 5, aligning well with the period of highest corn N needs. An accumulation of ammonium-N was not detected and ISNT-N remained stable over time, suggesting that timing of ISNT sampling for the clover-based system can occur before or after plowdown. In the conventional system, sidedressing of ammonium nitrate greatly increased soil nitrate-N. Side dressing with AN increased ammonium-N levels for 2-3 weeks and temporarily raised ISNT-N values. During that time ISNT-N measured both ammonium-N from fertilizer and N supply from mineralization of soil organic matter. Preliminary observations are that in cropping systems where N fertility is derived from a clover cover crop, ISNT sampling is not restricted in time, whereas sampling within 2-3 weeks after addition of an ammonium containing fertilizer should be avoided for accurate interpretations of soil N supply with the ISNT.

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12. Effect of Sampling Protocol on Corn Stalk Nitrate Test Results

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The end-of-season corn stalk nitrate test (CSNT) measures nitrate concentrations in the lower portion of corn (*Zea mays* L.) stalks at harvest time. The CSNT helps farmers adjust nitrogen (N) management over time and on a field by field basis, indicating if N availability for corn that season was low, optimum or in excess of what the crop needed. The recommended CSNT sampling protocol is to collect a 20-cm portion of each stalk, between 15 and 35 cm above the ground at corn harvest time with a minimum density of one stalk per acre. To evaluate the impact of taking shorter stalk samples (15-17.5 cm length) to save on mailing and analytical costs, five 50-cm stalks were collected (in one row) from 0 to 50 cm above the ground for ten corn fields in central NY. Each stalk was separated into eighteen 2.5-cm segments (combining 5 plants to obtain enough material per section). Stalk segments were dried and ground to pass a 2-mm screen, and CSNT-N was measured using the $Al_2(SO_4)_3$ extracting solution and a nitrate ion electrode. Stalk nitrate levels decreased with distance from the soil. The results showed 15-cm stalks taken 17.5 cm above the ground and 17.5 cm stalks taken 15 cm above the ground gave CSNT-N results that were not significantly different from CSNT's taken with the standard 20-cm stalk protocol. Results of weekly sampling from silage harvest time to grain harvest time in 2008 and 2009 showed samples could be taken any time between silage and grain harvest but indicated spatial variability within fields. Sampling of ten locations within a corn field in 2009 confirmed the existence of such spatial variability. Future research should focus on evaluation of causes of spatial variability of the CSNT.

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13. Nitrogen Balances for New York State: Implications for Manure and Fertilizer Management

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New York (NY) has dairy, cash grain, and horticultural industries located in close proximity to water, making it important to optimize manure and fertilizer use for both economic production of crops and protection of the environment. Our objectives were to (1) estimate state, regional, and county-level gross nitrogen (N) balances, (2) evaluate N balance trends over time; (3) estimate non-legume cropland (net) N balances; and (4) quantify the potential impact of improved herd nutrition and manure incorporation on N balances. The 2007 NY gross N balance for non-legume cropland was +62 kg ha^{-1}. Long Island and western NY had the highest N balances (+101 and +77 kg ha^{-1}, respectively) reflecting N fertilizer use for horticultural and/or cash grain crops (both regions) and presence of a significant dairy cattle population (western NY). The statewide N balance decreased from +125 kg ha^{-1} in 1987 to +62 kg ha^{-1} in 2007, largely driven by a decline in N fertilizer use between 1987 and 1992. The 2007 statewide N balance amounted to -38 kg ha^{-1} when manure N losses in the barn and storage and land application losses were taken into account. Improvement in herd nutrition through precision feeding has the potential to increase N use efficiency of spring-applied, non-incorporated manure. However, such improvements will also reduce the total amount of N excreted and decrease the N:P ratio of the manure. Given a nearly zero P balance for NY (+1.7 kg ha^{-1} P in 2006), a negative N balance indicates the need for best management practices that increase N use efficiency of manure and fertilizer (timing, rate, source, method) and/or add N from other sources (cover crops, greater reliance on N fixation, shorter rotations) in order to balance N and P for the long-term sustainability of NY agriculture.

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14. Evaluation of the K Saturation and Soil Test K Approaches for Their Effectiveness in Predicting a Yield Response to K Addition

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Potassium (K) is an important nutrient for alfalfa (*Medicago sativa* L.) in terms of yield, quality and winter hardiness. Due to increases in K fertilizer prices over the years, farmers are asking questions about soil testing as tool for K management. The objectives of this study were to (1) evaluate two soil-test based K management strategies: (i) sufficiency concept using the Cornell Morgan soil test, and (ii) K saturation ratio according to the basic cation saturation ratio concept (BCSR), for their ability to predict likeliness of a yield response upon addition of K fertilizer; and (2) compare a newly developed $SrCl_2$ extraction-based methodology for determining K saturation to the Morgan derived K saturation. Crop response to K fertilizer was measured in alfalfa field trials and in a greenhouse bioassay with annual ryegrass (*Lolium multiflorum* Lam.) with soils varying in soil test K (STK) and K saturation levels. Soil analyses (0-20 cm) prior to K application showed the two K saturation determination methodologies were linearly correlated with greater variability in calcareous soils (r^2=0.88, n=22) than acidic soils (r^2=0.99, n=6). Despite a trend toward higher yield with higher soil test K (r^2=0.43) and K saturation (r^2=0.50, Morgan; r^2=0.56 for $SrCl_2$ derived K saturation), there was no consistent yield response to extra K in the bioassay, and no response in the field trials when soil test K levels exceeded 60 mg kg^{-1} or $SrCl_2$ derived K saturation over 1.6%. We conclude that no yield response should be expected with soils testing 60 mg kg^{-1} or higher in Morgan K or 1.6% or higher in K saturation. Response studies need to be conducted on more soil types with both low Morgan soil test K and K saturation, in particular, to determine if the findings of this study can be extrapolated to other fields.

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15. Impact of N Fertilizer Sources on Corn Silage Yield and Quality

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New fertilizer technologies have focused on increasing N use efficiency by reducing N volatilization and leaching losses of fertilizer materials. Two such polymer-based technologies are: (1) ESN (Environmentally Smart Nitrogen, developed by Agrium Inc.), and (2) NutriSphere-N (by Specialty Fertilizer Products Inc.). Research plots were established at three locations to study the impact of use of ESN and NutriSphere on nitrogen availability and silage yield and quality. Corn (*Zea mays* L.) silage trials were located at Cornell research farms in Cayuga (2009), Essex (2008 and 2009) and Columbia (2009) counties. The treatments were: (1) Starter only; (2) UAN; (3) Urea; (4) NutriSphere-N; and (5) ESN. Nitrogen was applied at a rate of 168 kg N ha^{-1} and broadcast and incorporated at planting (urea, NutriSphere-N and ESN) or injected when the corn was between 15 and 30 cm tall (UAN). All sites received starter fertilizer with 34 kg N ha^{-1}. Soil was sampled at planting, sidedressing and harvest. Yield and forage quality were measured. All sites showed a yield response to N addition beyond the starter in both years. There were, however, no significant yield differences among N sources or timing of application. On average, the yield response to extra N beyond the starter was 19.3 Mg ha^{-1}. There were few differences in forage quality and none that impacted the overall silage quality as expressed in estimated milk production per Mg of silage. Results may have been impacted by reduced mineralization due to less than ideal spring mineralization conditions in both years (cool dry May in 2008; cool and wet in 2009 and an overall cold wet growing season in 2009) . Additional testing is needed in future years.

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16. Estimating Nutrient Losses from Tile-Drained Fields in Northern New York

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Subsurface tile drainage is an important management practice for farms with imperfectly drained fields. In Northern NY, tile drainage has been critical for improving crop yields and soil conditions for over a century. Potential nutrient losses associated with tile drainage systems has come under increased scrutiny as a potential nutrient source to surface waters. However, few field-scale studies in the Northeast have investigated nitrogen (N) and phosphorus (P) loss at the field scale over multiple seasons. The objective of this project is to evaluate N and P losses in two Northern New York tile-drained fields over multiple cropping seasons under a typical crop rotation (alfalfa-corn). The main research site is located at the William H. Miner Agricultural Research Institute in Chazy, NY, with an additional site located at nearby private dairy farm. In 2009, ten tile mains were equipped with water control structures to enable flow measurement and water table manipulation. Preliminary monitoring of tile drainage N and P concentrations has shown episodic leaching of P at both sites. Water flows and nutrients will be monitored during 2010 and 2011 to enable annual estimates of N and P losses. Results from this project

should provide a better understanding of the potential for nutrient losses in subsurface drainage.

17. Geospatial Assessments of Cropping Systems and Farmland Assemblages in New England

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Detailed assessments of the current state of crop production systems are essential to modeling potential productivity and evaluating core issues of sustainability for local to regional food supply studies. The main objectives of this regionally-based geospatial investigation were to evaluate the most current patterns of landcover for Maine (ME), New Hampshire (NH), Vermont (VT), Massachusetts (MA), Connecticut (CT), and Rhode Island (RI) using the USDA, NASS, 2009 Crop Data Layers, profile the top cropping systems in each state, and map select county-level farmland meristics (2007 Census of Agriculture). This initial integration of datasets will allow us to gain a better understanding of farmland distributions, potential production capacities, and possible environmental impacts, while beginning to gauge the potential to meet consumer needs at multiple scales. Aggregation of select National Land Cover Datasets (NLCD) for developed acreages revealed that RI, MA, and CT have sustained the greatest farmland losses ranging from 24.4-29.7%. In sharp contrast, ME, NH and VT are well below the 10% threshold in state-wide extents of developed lands. The dominant cropping systems across the region are hay/pasture/grass/ alfalfa admixtures supporting livestock, dairy, and/or egg production. These collective coverages vary from 3.3% (approx 687,000 ac in ME) to 11.8% (VT – with the highest acreage investment of approx 726,300 acres). Land devoted to corn across New England exceeded 350,000 acres, whereas cumulative acreage for small grains (oats, rye, barley, wheat, etc.) was 70,500. Fallow/Idle cropland ranges from approx 1,100 ac (RI – approx 0.2%) to 12,600 ac (VT – 0.2% of 6,200,000 ac statewide). Derived map products resolved areas and/or corridors in the landscape where CDL pixel diversity was high (≥5 out of 9 cells) and edge effects may be enhanced. These types of geospatial agronomic systems assessments contribute to evaluating our capacity to meet regional food demand.

18. Perennial Grass Management Influences Combustion Characteristics

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Perennial grasses have many positive characteristics for bioenergy, but also can have relatively high N, K, Cl, and S concentrations, which can all impact combustion and subsequent emissions. Our objective was to evaluate the effect of fertility treatments on yield and chemical composition of switchgrass (Panicum virgatum L.), reed canarygrass (Phalaris arundinacea L.) and tall fescue (Festuca arundinacea Schreb.) on a well-drained sandy soil and a relatively poorly drained clay soil. Blocks of grasses with 6 replicates at each site were seeded in 2006 and fully established in 2009. Six treatments included a check, N fertilizer only, N and P fertilizer, N, P and K fertilizer, manure and compost. Nitrogen rates were 84 kg/ha for switchgrass and 168 kg/ha for cool-season grasses, P rate was 26 kg/ha P205, and K rate was 67 kg/ha K20. Manure application rate was 89.6

Mg/ha and compost application rate was 44.8 Mg/ha, applied at spring green up. Manure and compost rates were set to provide similar amounts of N. Cool-season grasses were harvested in early July and mid October, switchgrass was harvested in mid October. Samples were analyzed for elemental composition, fiber, lignin and ash. Switchgrass yield was highest, and was least affected by treatment, while the manure, compost and check treatments produced lower yields than commercial fertilizer treatments for cool-season grasses. Composition was greatly affected by species and treatment, with fewer differences due to site. Manure treatment generally was highest in ash, K and Cl, with compost ranking second among treatments for ash, K and Cl. Chlorine, a problematic element for combustion, ranged from 13.6 g/kg in first growth of cool season grasses with manure, to 0.7 g/kg in switchgrass fertilized with N. Manure and compost treatments resulted in consistently very high Cl in the biomass.

19. Can Soil Pore Water Electrical Conductivity Data Logging Sensors be Used to Monitor Cover Crop Decomposition and Nitrate Release *In Situ*?

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Capacitance sensors measuring soil water content and sensors measuring soil electrical conductivity (ECa) are now widely available and can be combined to monitor the EC of soil pore water (ECw). We used ECw, as measured by such sensors, to study nitrate dynamics in non-saline Mid-Atlantic Coastal Plain soils during growth and decomposition of cover crops (forage radish, *Raphanus sativus* var. longipinnatus and cereal rye, *Secale cereale* L. cv. Wheeler). Trends in ECw matched those expected for nitrate release from January through May for two cover crops with contrasting overwintering and residue decomposition characteristics. Plots with higher ECw measured in situ were also higher in nitrate. However, the overall correlation between nitrate and ECw measured in situ was not significant. There was a significant relationship between measures of nitrate and EC as measured on soil samples in the lab. Further work is needed at higher levels of nitrate and in a wider range of soil types to better develop quantitative relationships between ECw and nitrate in field soils.

20. Diversifying Monoculture Crop Through Incorporating Prairie Buffer Strips

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Planting vegetative buffer strips in crop fields can dually act to conserve native plant species and to provide other ecological benefits to the agricultural system, including soil and water conservation and nutrient retention. Despite these potential benefits, farmers may equate buffers with increased risks of weeds within adjacent crops. To study potential advantages and disadvantages of using buffer strips composed of native, perennial prairie species, we are conducting a watershed-level experiment at the Neal Smith National Wildlife Refuge (Jasper County, Iowa). We divided 12 watersheds into three treatments with varying buffer designs (10% perennial cover at the toe-slope position; 10% perennial cover distributed in strips along the slope; 20% perennial cover distributed in strips along the slope) and one all-crop treatment (corn-soybean yearly rotation). We conducted vegetative surveys in the buffers and analyzed the effect of buffer design on plant species diversity (number of species) or percent cover of plants. In addition, we conducted vegetative surveys in the crop portion of the 12 watersheds to analyze differences in percent cover of non-crop plants between watersheds with buffers and watersheds with all-crop. In 2009, we identified 104 plant taxa within the buffers, 72 native and 32 non-native species. There was an average of 46 species in watersheds containing buffers, but only 12 species in all-crop watersheds. Within the buffers, mean plant cover was 74%, with native perennial species providing on average 20% cover. There were no statistical differences in mean plant cover among the three buffer designs. There were also no statistical differences in mean non-crop plant cover within the crop between watersheds containing buffers and all-crop watersheds. These findings suggest converting at least 10% of a monoculture crop watershed into buffers will increase biodiversity, consequently increasing ecological benefits resulting from perennial and native species, without increasing weeds within adjacent crops.

21. Comparison of Tall Fescue Cultivars for Yield and Quality of Spring Growth

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Our objective was to evaluate a method to compare yield and digestibility of entries cut on the same spring day by adjusting yield and digestibility to the same NDF level. This was accomplished by determining the linear rate of change of yield and quality over time. Five separate environments from 2003 to 2009, each with from 3 to 18 tall fescue entries and 2 to 6 replicates, were sampled for yield and quality using a quadrat (0.06 m or larger) and clippers. Experimental design was an RCBD with a split plot feature, with entries as the main plot and sampling dates as the sub plots. Sites were located in Chazy, Freeville, and Ithaca, NY. Each trial had at least 5 different spring sampling dates separated by 2 to 4 days between mid-May to early June, when the change per day in yield and quality is generally linear. Rates of daily change were determined using regression analysis, and analysis of covariance was used to determine if slopes were equal. Rates of change per day of yield and quality were different (P < 0.05) across environments, but varieties within a given environment did not differ significantly (P = 0.05) in NDF, in vitro NDFD, or yield rate of change per day. Across environments NDF concentration increased from 8 to 12 g/kg/day, while digestible fiber decreased from 7 to 12 g/kg/day. Rate of change in DM yield was relatively consistent within each environment, but varied from 115 to 275 kg/ha per day across environments. Based on our results, it is possible to sample representative cultivars during a period of linear change in yield and quality starting in mid-May and use this information to adjust yield and quality of all entries in a cultivar trial to their individual optimum harvest dates based on NDF content.

22. Correlations among Forage Quality, Yield, and Maturity for Alfalfa in Central New York

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Alfalfa produces forage three or more times in a growing season. At each growth phase, producers strive to maximize forage yield and forage quality. Generally at the forage matures, the yield increases and the forage quality decreases. Correlation coefficients among yield, maturity, and five forage quality constituents were determined for alfalfa populations in five alfalfa trials planted at Ithaca New York from 2004 to 2009. The five forage quality constituents determined were percent neutral detergent soluble fiber, percent neutral detergent fiber, percent acid detergent fiber, percent lignin, and percent *invitro* true digestibility. In each trial there were sixteen alfalfa populations, replicated five times. The trial entries included two cultivars; a check cultivar for high forage quality ('WL 322HQ') and for low forage quality ('Vernal'), as well as various experimental alfalfa populations. Correlations are reported for each of three harvests times (early June, mid-July, and late August).

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23. Optimized work-flow for assaying tomato fruit quality: Vitamin C, titratable acids, brix and lycopene

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The USDA, ARS Plant Genetic Resources Unit conserves several-thousand cultivated tomato (Solanum lycopersicum L.) lines that are made publically available for breeding and research through the National Plant Germplasm System. An ongoing challenge is to characterize the collection for traits that are of interest to endusers. During 2008 and 2009 we adopted and optimized laboratory methods to efficiently estimate fruit nutritional traits vitamin C (ascorbic acid), titratable acids, brix and lycopene. Results were highly reproducible and we have found significant differences among genotypes for the various traits. These data will be made available through the Germplasm Resources Information Network. Here we present the protocols and work scheme for efficiently assaying hundreds of samples during a field season.

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24. Effective Foliar Treatment of Manganese Deficiency in Soybean

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Manganese deficiency is a recurring problem in many crops grown on Atlantic Coastal Plain soils, especially soybean (Glycine max L. Merr.). Field trials were conducted with soybean grown on a sandy loam soil, near Adelphia, NJ. The experimental site had a long history of crops exhibiting manganese deficiency, with an initial soil pH of 7.5, Mehlich-3 extractable Mn of 12 mg kg-1, and soil organic matter content of 2.3%. A Roundup Ready Soybean variety was used to study crop response to Mn fertilizer treatments as glyphosate (ai) has been suspected of increasing the severity of manganese deficiency. The first trial compared manganese sulfate to chelated manganese as foliar fertilizer applications. Crop response showed increased seed yield with application of Mn fertilizer, but no significant differences were exhibited between the two Mn fertilizer sources. The second trial compared different rates (0, 0.5, 1.0, 1.5, and 2.0 lbs Mn acre-1) and frequencies (none, once-at emergence of first trifoliate, twice-at first trifoliate and at early bloom, or three times-at first trifoliate, early bloom, and early pod fill) of foliar applied manganese fertilizer as manganese sulfate. As expected, during both trials, plants without foliar Mn fertilizer treatment exhibited severe Mn deficiency showing classic symptoms of interveinal chlorosis or leaf yellowing. During the second trial, a minimum of three foliar applications of Mn were required to achieve yield potential. However, there was no advantage to using application rates greater than 0.5 lbs Mn acre-1. On field sites severely deficient in

Mn, effective correction of Mn deficiency requires frequent, but low, application rates of foliar Mn fertilizer. Manganese sulfate and chelated manganese fertilizers appear to reduce deficiency symptoms and increase yields of Roundup Ready Soybean grown on Mn deficient soils similarly.

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25. Yield and Composition of Bio-Char from Pyrolysis of Sorghum at Varied Temperature

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Pyrolysis of crop biomass yields a co-product, bio-char, which could be recycled to sustain soil quality and crop productivity. Previous reports indicate bio-char resists microbial degradation, returns essential mineral nutrients, and enhances cation exchange capacity in amended soils. Yet, bio-char properties and effects on soil depend on feedstock characteristics, pyrolysis conditions, and processes used to separate bio-char from bio-oil and syngas co-products. The objective was to evaluate physical and chemical properties of bio-char produced from three sorghum cultivars at 400, 500, and 600 C in an auger-fed, slow pyrolysis system. Although biomass yield differed two-fold among sweet sorghum cultivars, lignin concentrations were less than 100 g/kg and minimum mean concentrations were only 26% less than the maximum. Bio-char yields were relatively high (46% of feedstock weight) and did not differ among pyrolysis temperatures or sorghum cultivars. In addition, particle size distribution and particle density of bio-char were similar among pyrolysis temperatures and sorghum cultivars. Recycling of bio-char at a rate representing bio-char yield per Mg of biomass produced will return 50% of the organic C per Mg of biomass harvested from production fields. Yet, available P and K amounts recycled through bio-char were not sufficient to replace amounts used to produce a Mg of biomass equivalent to that pyrolyzed.

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26. Preharvest Neutral Detergent Fiber Concentration of Temperate Grasses as Influenced by Stubble Height

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Regression equations can be used to estimate the preharvest neutral detergent fiber (NDF) concentration of temperate grasses. Our objective was to develop NDF equations for grasses that incorporate stubble height. Stands of first-cut orchardgrass, reed canarygrass, and timothy were sampled in producers' fields in New York in 2008, and cut into 5-cm segments. Predictive NDF and dry matter (DM) equations were developed for each segment. Equations describing the change, with grass height, in the contribution of each segment to the overall DM were used to develop equations for predicting whole-plant NDF. The r2 values for estimating DM ranged from 0.56 to 0.93, and the r2 values for estimating NDF ranged from 0.67 to 0.90 for the individual segments, depending on the species, segment, and explanatory variables used. For DM the results were very similar for all species examined, and r2 values for multi-species equations ranged from 0.72 to 0.88. For NDF, multi-species equations performed more poorly with r2 values ranging from 0.49 to 0.62. The r2 values for predicting whole-plant NDF ranged from 0.72 to 0.87 for orchardgrass, 0.61 to 0.69 for reed canarygrass, and 0.67 to 0.77 for timothy. With further model evaluation the equations could be used by

New York producers to obtain a more accurate estimate of preharvest NDF concentration.

27. Manure Nutrient Variability Across a Spreading Event, Years, and Multiple Dairy Operations

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With high fertilizer prices and new nutrient management regulations there is great interest in using dairy manure to its greatest advantage. Current recommended practice for liquid manure is to take one (well-agitated storage) to three (non-agitated storage) samples per spreading event and to maintain a 3-year running average for nutrient management planning. The objectives of this study were to: (1) determine the number of samples needed per field and per spreading event for the accurate estimates of manure nutrient content, (2) evaluate manure nutrient content variability across farms, and (3) evaluate the implications of using a 3-year running average for current year nutrient management planning. Manure samples were taken (1) for every load while spreading on a 5 and 8 hectare field (13 and 19 acres), (2) for every 230,000 to 380,000 liters (40,000 to 100,000 gallons) during emptying of 2,650,000 to 18,930,000 liter storages (700,000 to 5,000,000 gallons) on four farms, (3) for eight farms (spring sampling for two years), and (4) for one farm (spring spreading) from 2001 through 2009. Samples were analyzed for total N, P and K, ammonium-N, and solids. Variability in nutrient content of different loads taken within a field or during a single spreading event was small but each batch of samples contained one "outlier" indicating the need for a three-sample minimum to identify and discard outliers. Farm to farm variability was high, indicating the need for farm-specific sampling. There was no difference between using a 3-year running average and prior year analyses for planning of current year manure applications as long as spreading event averages were based on two or three subsamples and outliers were discarded. We conclude, for most accurate planning, three samples be taken and analyzed individually for every spreading event and individual farm storage, and outliers be discarded.

28. Nitrogen Dynamics Following Surface-Application of Enhanced Efficiency Fertilizers

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Nitrogen (N) is essential for the development of all crops and required in large quantities for important field crops like corn (*Zea mays* L.). Nitrogen fertilizer efficiency can be increased if N loss can be reduced. Urease inhibitors, nitrification inhibitors, and slow and/or controlled release fertilizers are all enhanced efficiency technologies designed to reduce ammonia volatilization, nitrate leaching, and/or denitrification. An incubation study was conducted to compare ammonia, ammonium and nitrate dynamics following surface application of urea, Agrotain® (urease inhibitor), Super U® (urease and nitrification inhibitor), NutriSphere-N® (urease and nitrification inhibitor), and ESN® (urea encapsulated in a controlled release polymer). The experiment was conducted in 4 replications with destructive sampling at 0, 7, 14, 21, 28, 35, 42, 56, and 91 d after fertilizer application (0.11 g of N in 100 g soil). Throughout the incubation, samples were maintained at 75% field capacity with an initial temperature of 10˚C which was increased incrementally to reach a final temperature of 21˚C at the end of the 13-wk study. Ammonia-N was determined using a boric acid trap (3-hr closed chamber assessment). Ammonium-N and nitrate-N were determined using a 2 *M* KCl extraction. Results show elevated (3x) volatilization loss for urea and Nutrisphere-N® 7 d after application. Ammonium-N was higher for urea and NutriSphere-N® than for Super U® and Agrotain® from day 7 through 42, while ESN® showed elevated ammonium-N levels after 56 d only. Soil nitrate-N levels following Agrotain® and Super U® application were higher than when urea or NutriSphere-N® were applied while ESN® showed nitrate-N levels beyond the control after 28 d of incubation, once daytime temperatures (15 h) reached 15°C. This study showed Agrotain®, Super U® and ESN® to be effective enhanced efficiency fertilizers. Field trials are needed to evaluate growing conditions under which their use would be economically beneficial.

29. Web-based Course for Aspiring Northeast Region Certified Crop Advisors

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The Certified Crop Adviser (CCA) Program is a voluntary professional certification program offered by the American Society of Agronomy (ASA). It is the largest certification program in agriculture with 12,871 certified throughout the USA and Canada. The Northeastern Region, (Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont) counts 310 CCAs. To become certified, aspiring CCAs need, among other requirements, to pass two exams, an international and a regional exam. Test questions are based on the performance objectives (POs) outlined for four major competency areas (CAs): nutrient management, pest management, crop management, and soil and water management for each of the two exams (see https://www.certifiedcropadviser.org/files/obj_icca.pdf for the international POs and https://www.certifiedcropadviser.org/files/obj_northeast.pdf for the POs of the Northeastern Region). The Northeastern Region CCA (NRCCA) board holds an annual, 3-day training in New York during which aspiring CCAs get exposed to the material for the exam and go through practice questions for the NRCCA exam. Similar events are being held in other states. Although the board has made available a study manual for NRCCA exam (http://www.northeastcropadvisers.org/index_files/Page911.htm), there is little opportunity for active learning beyond attendance of the annual training. The current format does not allow for university student participation as training sessions often occur during the semester, and the number of faculty instructors is decreasing due to staff reductions at land grant universities. In response to these challenges, in 2010, a new course website was developed (http://nrcca.cals.cornell.edu) with learning modules and materials that prepare prospective NRCCAs for the regional exam. In this presentation, we will show the learning modules and web-based resources available to aspiring NRCCAs.

30. Evaluation of Nitrogen Management of Corn Using the Illinois Soil Nitrogen Test and Corn Stalk Nitrate Test

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Recent studies have shown the Illinois soil nitrogen test (ISNT) and late-season corn stalk nitrate test (CSNT) to be effective in identifying fields with the potential for nitrogen (N) fertilizer savings for corn (*Zea mays* L.) in New York (NY). A study was initiated in NY to: (1) quantify the distribution of CSNT and ISNT values across corn fields; (2) evaluate drivers for high CSNTs and ISNTs; and (3) calculate potential N fertilizer savings resulting from CSNT and ISNT-based management adjustments. Soil and corn stalk samples were collected from 105 corn fields (2635 acres). All samples were submitted by farmers or farm advisors and accompanied by field information (field size, crop rotation, crop variety, and fertilizer and manure use). Of the 708 acres in first year corn after alfalfa/grass, 35, 35 and 30% tested low, optimum and excessive in CSNT, while only 11% tested above the critical value for ISNT. The results showed considerable differences in CSNT status among management categories based on manure and fertilizer uses and soil management groups while main driver for high ISNTs were manure application and organic matter content of soils. As 1st year corn requires no more than 30 lbs N/acre as a starter, the average potential N fertilizer savings across this acreage amounted 65 lbs/acre. For 2nd or higher year corn (1927 acres), 18% tested above the critical ISNT-N value for corn responsiveness while 26, 26 and 48% tested low, optimal and excessive in CSNT, respectively. Limiting N application to 30 lbs N/acre for fields with CSNT >2000 and ISNT above the critical value, and for fields with a CSNT>5000 ppm independent of ISNT resulted in an estimated savings of 58 and 42 lbs N/acre, respectively. We conclude that use of CSNT and ISNT tests result in significant reductions of fertilizer N for corn.

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31. Dairy, Livestock and Cash Grain Farmer Perceptions of the Value of Manure

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Increased fertilizer prices have resulted in a greater awareness of the value of manure. New York (NY) crop and dairy producers were surveyed from late 2009 to early 2010 to assess their use of and their opinion of manure. The crop producer surveys were used to determine: number of acres and types of crops grown; number of producers who used and/or bought manure; perceived benefits and value of manure; reasons for using manure; and concerns associated with applying manure. Dairy producer surveys were used to assess: number of animals and tillable acres; manure storage capacity; percent of total acreage receiving manure and application costs; frequency of manure testing for N, P, and K content; frequency of manure export and payment structure; reasons for not selling/exporting manure to other farms; and perceived benefits and value of manure. In total, 293 surveys were completed during 15 extension meetings (200 dairy, 66 crop, and 27 livestock operations), representing 38 NY counties and 7 counties from Vermont, Connecticut and Maine. Dairy producers valued their manure at $96/acre while livestock and crop producers valued manure at $56 and $53, respectively. Crop producers who purchased manure paid, on average, $88/acre. Dairy, livestock and crop producers considered nutrient content and organic matter the greatest assets of the manure. Many dairy/livestock producers indicated there is a potential market for manure yet only 33% of producers export manure, reflecting the need for manure on the dairy/livestock farm itself. Consistent with this finding, the main concern identified by crop producers was manure unavailability; cost was less important to most crop producers. These results indicate there is a potential market for manure export in NY.

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32. Using Whole Farm Mass Balances as a Management Tool on New York State Dairy Farms

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Nutrients imported onto livestock farms in excess of nutrients exported contribute to nutrient accumulation and/or environmental degradation. Whole farm mass nutrient balance (MNB) assessments can help quantify and manage such (im)balances. Our objectives were to: (1) document nitrogen (N), and phosphorus (P) balances for a wide range of dairy farms; and (2) identify drivers for N and P balances. In 2006, 101 annual MNB surveys were done on New York State (NY) dairy farms ranging in size from 24 to 2,300 milking and dry cows with tillable crop and pasture owned and rented ranging from 21 to 1,619 ha. Nitrogen and P balances were calculated by summing the nutrients in imported feeds, fertilizers, animals, and bedding and subtracting exported nutrients in milk, animal and crop sales and manure and/or compost exports. Production characteristics such as cropland area, animal numbers, and average crop yields were recorded. Individual farm balances ranged from -19 to +278 kg/ha N and -8 kg/ha to +50 kg/ha P. Balances per 100 kg milk produced ranged from -1.3 to + 2.6 kg N and -0.1 to +0.5 kg P. Nitrogen and P remaining per tillable ha increased with production intensity (milk produced per tillable ha; r^2=0.52 for N; r^2=0.31 for P) and animal density (animal units per tillable ha; r^2=0.50 for N; r^2=0.22 for P). Other important drivers which influenced N and P remaining per ha included farm size (animal numbers and land units), percentage homegrown feedstuffs percentage, crop yields, and crop sales. Nutrients remaining per unit of milk production were primarily driven by crop sales (r^2=0.15 for N; r^2=0.14 for P) and homegrown feedstuffs percentage (r^2=0.09 for N; r^2=N.S. for P). The MNB assessments provide a useful metric for evaluating farm nutrient management. Evaluation of MNBs over time is needed to document farm progress over time.

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33. Cover Crop Practices and Usage among Dairy Farmers in Washington County, New York

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Cover crops serve as a valuable tool in run-off control, erosion control, and reduction of nutrient leaching from agricultural land. This is especially important in corn (*Zea mays* L.) silage cropping systems where most above ground biomass is removed with harvest. Although cover crops are part of a sustainable recipe for healthy farmland in the long term and recommended for use by dairy farms, especially in highly erodible or leachable soils, the acreage of cover cropped land is still limited in New York State (NY). Two surveys were conducted, one for farmers with experience with cover crops and one for farmers that had never used cover crops. Each survey asked background information such as: tillable acres, number of animals, and primary tillage practices. Both surveys asked input on cover crop related research and extension needs. The surveys differed in the current practices section, focusing on success stories among those with experience with cover crops while focusing on barriers to implementation for those without cover crop experience. Surveys were conducted among dairy farms in Washington County, a large contributor to the dairy industry in NY with 33,100 acres in corn (for grain and silage) in 2008. This corn acreage makes up 16.5% of the county's total farmland (200,800 acres) and nearly half of the tillable acres in corn and hay rotations (70,800 acres). Those with cover crop experience were asked about implementation practices and the impact of cover crop use on farm income, fertilizer needs, and tillage practices. Those without experience were asked what prevents them from using cover crops and what should be done to make cover crops more appealing to their businesses. Data collection is ongoing and results will be shared.

Regular Talks – Crops

34. Yield, Quality and Time of Harvest of Tall Wheatgrass for Biomass Energy

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The use of perennial grass for energy production is a sustainable alternative to annual crops and provides many ecosystems services. Two tall wheatgrass studies were established on 9/4/07 in Corning, NY, on a Unadilla silt loam soil and evaluated in 2008 and 2009. A cultivar yield trial was conducted with tall wheatgrass varieties 'Alkar', 'Jose', 'Largo' and 'Szarvasi-1', intermediate wheatgrass 9051920 and 'Bellevue' and 'Chiefton' reed canarygrass. The grasses were managed under a 2-cut harvest regime, and fertilized twice per year with 74 kg N/ha. The second study evaluated first cutting dates with two varieties of tall wheatgrass, 'Alkar' and 'Szarvasi-1', fertilized once per year with 84 kg N/ha. The cutting dates started on 7/3 and continued approximately once a week for four weeks. Chemical analysis for fiber, ash and minerals was conducted in 2009. Wheatgrass yields were comparable to the reed canarygrass, with average yields of both grasses for both years of 11.2 Mg/ha (5.0 t/a). In the tall wheat grass time of cutting trial 85% of the total yield was obtained from the single cut system in the last week of July with an overall average yield for both years of 9.9 Mg/ha (4.4 t/a). The late July cutting date is compatible with ground nesting bird management and occurs at a time with easier drying and harvesting. Chemical analysis showed trends of decreasing K (1.0%), Cl (0.15%) and ash (3.4%) with later cutting dates perhaps due to senescence and lower leaf:stem ratios.

35. Planting Density and Plant Growth Regulators Impact on Castor Bio-oil Production in the Northeast

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Castor (*Ricinus communis* L.) is a semitropical perennial plant successfully grown for three years as a renewable fuel source in the Northeast USA. Castor, an ideal candidate for bio-oil production with higher oil yield potential than soybean or canola, it is not used for food, and can be grown productively on marginal uplands of the region. The extremely high oil content and yield potential of castor generates a positive energy balance producing 4 to 8 calories in liquid fuel per calorie invested in production/processing. It can be used for heating oil and as a premier lubricant replacing petroleum based oils and there is a market for every liter produced. The objective of this study was to evaluate the impact of row width (38 and 76 cm), in-row spacing (30, 46, 61, 91 cm), and the use of plant growth regulators (PGR) on castor oil yields. Field trials were conducted at the Cornell Valatie Research farm on a Knickerbocker fine sandy loam using the variety Hale. Deep zone tillage (43 cm) was used, as in 2008 it had a significant beneficial impact on root and top growth. Castor seeds were planted when June 1 at 3.8 cm deep, 15.8 cm in row thinned to desired density. The narrow rows maximized intercepted light in the short season and had a major effect in keeping late season weed pressure to a minimum. The 38 cm row spacing out yielded the 76 cm row in both 2008 and 2009. The 30.4 cm in-row spacing gave the highest yields (216 L/ha) while the use of PGR's decreased yields in all tests. This research shows there is considerable upside yield potential for this already high yielding oil crop when planted at 38 cm row width and 30 cm in-row spacing.

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36. Mustard Cover Crop and Nitrogen Influence on Potato Yield and Quality

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Potato grower interest in less input-intensive solutions is growing. Lengthening rotations and use of cover crops have shown promise to build soils and increase plant resistance to pests. Previous research indicated that plowed down high glucosinolate mustard (HGM) grown prior to potatoes increased potato yield by 5-10%. HGM represents a hardship to growers due to loss of crop. Do benefits of HGM justify the loss. Replicated strips of barley, canola, and HGM were planted in 2007, 2008 and 2010. Barley and canola were harvested. HGM was mowed and incorporated. Year after, Kennebec potatoes were hand planted at 12 inch spacing. Five rates of N (0, 67, 135, 201, and 268 kg N ha^{-1}) were applied to each plot. Yields were taken on 4.5 m row segments, and scab and rhizoctonia measurements were taken on 25 potatoes from each plot. Widely different environmental seasons in 2008 and 2009 influenced potato response to N and HGM. Scab levels ranged from 5 to 6% (2008) and 2 to 3% (2009) of the potato surface area and were not affected by N. Rotation and N rate had a greater effect on rhizoctonia levels. Rhizoctonia was highest following canola and barley (2% of surface area) while plowed down HGM generally reduced rhizoctonia across all N rates compared to canola or barley. Potato yields were affected by rotation and N rate. Potatoes yields peaked at lower N rates following HGM, and between 45 – 65 kg N ha^{-1} was produced following HGM. A yield benefit was found with potatoes following HGM across all N rates compared to potatoes following barley or canola. Extending the potato rotation may reduce incidence of rhizoctonia in the potato year and provide as much as 65 kg N ha^{-1}.

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37. Impact of Date of Planting Winter Triticale for Dairy Forage

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Maintaining annual forage producing crops on the ground all year conserves soil, improves soil health, and can increase total yearly yield in a double crop scenario. Double cropping of annual forages with short season corn (*Zea mays* L.) has the potential to increase total yield 25% while opening windows for off-cycle manure applications. Forage triticale (*X Triticosecale* spp.) is increasingly used because of higher forage yield potential than rye (*Secale cereale* L.), or wheat (*Triticum aestivum* L.), and a harvest window that matches normal first cutting haylage. Harvested at flag leaf, triticale has forage quality with higher potential milk production as measured by Milk 2006 than brown midrib (BMR) corn. Traditionally planted September 20 in the Albany NY area, triticale is not affected by Hessian Fly as is wheat, and can be planted earlier to extend the time for tiller generation which is critical for maximize forage production. As part of a multi-pronged effort to document agronomic practices specifically for high forage production, winter triticale was planted each week from August 28 to October 2 using a randomized complete block design in four replications in eastern NY. Tillers per plant, plant height, stage of growth at harvest, and dry matter yield were measured. Height, number of tillers, and dry matter yield all increased with earlier planting date. These results suggest yield benefits from earlier planting dates and support the recommendation to plant winter triticale by September 1 in eastern NY.

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38. A Study to Look at Practices Aimed at Reducing Mechanical Cultivation in Organic Corn

Janice Degni
Cornell Cooperative Extension

An on-farm research trial with two farm collaborators study was undertaken to look at weed control in organic corn production through narrow row spacing (15” vs 30”) and use of mid-season cover crops. The effect of population thinning was measured at 8 and 11% for narrow rows and 9 – 18% for wide rows. The effect of cover crops at both sites was insignificant. At site 2 they didn’t establish and at site 1 they established in the wide rows that had been cultivated but growth was minimal since they were suppressed by the shade of the fully developed corn plants. Experience from this trial suggests that cover crops need to be established the season prior and suppressed before the current growing season’s crop establishment. There were row spacing and weed competition challenges at both sites that need to be considered when comparing yield results. At Site 1 narrow rows yielded 40.6 bu/ac and wide rows 123 bu/Ac dry shell corn. At Site 2 corn was harvested as silage a nd yielded 7 tons/ac. There was no statistically significant yield difference between 15” and 30” rows.

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39. Effects of Nitrogen Deficiency on Organic Nitrogen Metabolism in Leaves and Roots of Creeping Bentgrass

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Reduced N fertilization is recommended for creeping bentgrass on putting greens to prevent excessive shoot growth, but N deficiency induces leaf senescence. Understanding effects of N availability on N metabolism is important for increasing N use efficiency under low N fertility. This study was conducted at Rutgers University to examine responses to N deficiency of two enzymes in N metabolism, and amino acid and soluble protein contents in young and old leaves and roots of creeping bentgrass. Plants (cv. ‘Penncross’) were treated daily with a modified Hoagland’s solution containing 6 mM nitrate-N (+N plants) or no N (-N plants). Young and old leaves of individual plants were sampled separately from 4 replicates at 14, 21, and 28 d, and roots sampled at 28 d. Glutamine synthetase (GS) biosynthetic activity was higher in –N than in +N plants at 21 d and 28 d. Nitrogen deficiency increased GS transferase activity at all three dates and for all three tissues. NAD-dependen t glutamate dehydrogenase activity showed no significant difference in young leaves but was higher in old leaves of –N than in those of +N plants at 21 and 28 d and lower in roots of –N than in roots of +N plants. At 21 d and 28 d, NADH-dependent glutamate dehydrogenase activity was higher in –N than in +N plants and more so in old leaves than in young leaves. Amino acid content and soluble protein content were significantly higher in +N than in –N plants for all three tissues at 21 and 28 d of treatment. Our results suggested that N deficiency resulted in significant decline in total amino acid and protein content, but the activities of enzymes involved in glutamine synthesis and degradation were promoted, which may be an adaptive response for creeping bentgrass plants to cope with N deficiency.

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40. Understanding the Physiology And Mechanisms of Seed Dormancy in Switchgrass (*Panicum virgatum* L.)

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Switchgrass (Panicum virgatum L.) is a perennial warm-season grass native to North America established through seed. As with many perennial grasses, neoteric switchgrass seeds exhibit dormancy, resulting in delayed and sporadic germination and emergence, jeopardizing establishment of a good stand. Seed dormancy can be imposed by morphological, physical, and/or physiological properties. Switchgrass dormancy has been alleviated by mechanical or chemical scarification and by stratification, suggesting physical and/or physiological dormancy; the causes, mechanisms, and physiology of this dormancy, however, are not well understood. We investigate the contribution of the different switchgrass-seed structures to dormancy in 'Cave-in-Rock', removing layers sequentially under a dissecting microscope. Once specific tissues were identified to interfere with germination, the mechanisms involved were examined. Hormonal response to exogenously applied abscisic acid (ABA), gibberellins (GA), and fluridone (FLU) was also explored. Lemma, palea, and pericarp/testa are found to interfere with germination of highly dormant seeds. Germination at 30°C of intact seeds is 1–10%; germination of the same lot with glumes, lemma, and palea removed is 40–50%. Cutting of the pericarp and removing the endosperm results in faster and higher germination (96%), indicating no morphological dormancy, characterized by underdeveloped embryos. Lemma, palea, and pericarp/testa do not contain inhibitory compounds and the effect of seed coat in water uptake is negligible after 48 h. 'Cave-in-Rock' seed germination is highly sensitive to oxygen availability; lemma, palea, and pericarp/testa are found to interfere with oxygen uptake. The pericarp/testa mechanically constrain radicle protrusion. Results suggest that embryos are not only sensitive to ABA, and GA, but also synthesized de novo ABA during imbibition. Understanding the physiology and mechanisms involved in switchgrass dormancy will provide important and valuable information for future research focused on developing low-dormant cultivars and improved dormancy-breaking treatments.

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41. Precision Irrigation to Improve Water Use Efficiency

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Efficient water use is the key to sustainable management of water resources. Over irrigating is wasteful and can lead to leaching of fertilizers and other potential pollutants into both underground and surface water supplies, whereas under irrigation leads to reduced yields. The spatial and temporal characterization of crop water consumption is important for efficient management of water resources and allows water delivery to match agricultural demands. Research has shown the usefulness of remotely sensed data to obtain accurate information on land surface processes and conditions. These studies have demonstrated that quantitative assessment of the soil-vegetation-atmosphere-transfer processes can lead to a better understanding of the relationships between crop growth and water management. However, remotely sensed data remain underutilized by practicing water resource managers. The objective of this study was to characterize the spatial and temporal variations in water uptake by corn plants in a typical irrigated Delaware corn field. Datasets collected during the growing season included electromagnetic conductivity, remote sensing, soil texture profiles, and soil moisture.

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42. Adaptive Management of Winter Cover Crops Using Remote Sensing And Data Sharing Strategies

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The use of winter cover crops is one of the most cost-effective strategies for reducing agricultural non-point source nitrogen and sediment loads into the streams and estuaries of the Chesapeake Bay watershed. However, implementation is not always successful, there is a need for management tools that assist farmers, Soil Conservation Districts, and watershed planners to evaluate and improve the water quality benefits associated with winter cover crops. Over five years, scientists with the Choptank River Conservation Effects Assessment Project have developed methods to combine satellite-derived wintertime measurement of above-ground cover crops biomass with site-specific agronomic management data derived from cost-share program enrollment records, providing a field-by-field estimation of cover crop nutrient uptake on working farms throughout the landscape. Results show considerable variability in water quality benefits, resulting from both weather and from agronomic management strategies. Following initial success, the project is currently working to transfer geospatial techniques for cover crop evaluation to Soil Conservation Districts in Maryland, Virginia, and Pennsylvania, with a particular focus on promoting cover crop usage in corn silage farming systems. Remotely-sensed measures of conservation practice effectiveness can provide critical information to be used in an adaptive management framework to improve the water quality benefits associated with winter cover crops in the agricultural landscape.

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43. Heavy Fertilization with Compost and Manure Can Cause Weed Problems

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Choosing the correct application rate for organic nutrient amendments like manure and compost is notoriously difficult due to variation in nutrient content and weather dependent variation in release of nutrients during the growing season. Consequently, risk-averse farmers frequently over-apply these amendments. To develop compost application recommendations and study the consequences of over-application, compost was applied at various rates during the first three years of a corn – soybean – spelt/red clover – corn organic crop rotation. During the fourth year, no plots received compost in order to examine the effects of residual fertility. Giant foxtail (*Setaria faberi*), common ragweed (*Ambrosia artemisiifolia*), common lambsquarters (*Chenopodium album*), and Powell amaranth (*Amaranthus powellii*) all increased significantly in size in responses to compost rate in two or more years. In most cases, the response was linear, with the height of the weed continuing to increase up to the maximum application rate. In contrast, yield response of the crops to compost rate was either non-existent or asymptotic, with maximum yield achieved at a relatively low rate. Similarly, in a long term organic cropping systems experiment, plots receiving annual applications of poultry compost developed high biomass of both annual and perennial weeds relative to plots receiving similar weed management but minimal fertility amendments. In a third experiment, plots receiving high application rates of manure or compost developed high density populations of giant foxtail and other weeds whereas chemically fertilized plots did not. We conclude that over-application of organic amendments favors weeds relative to crops and poses a significant problem, particularly on organic farms.

44. The Cornell Organic Grain Cropping Systems Experiment: Nutrients, Yields and Net Returns through Transition and Beyond

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The Cornell Organic Grain Cropping Systems Experiment uses a three year rotation of soybeans, winter spelt overseeded with red clover and corn to compare three approaches to organic grain production: (1) a high fertility system to maximize yields, (2) a low fertility system aimed at maximizing net profit and (3) an intensive weed management system. Adjacent chemically managed plots provide a qualitative but not statistically valid control. The experiment began in 2005 and completed organic transition in 2007. Corn yields tended to be low during transition but were good in 2008, perhaps partially due to favorable weather. The additional fertility in System 1 did not increase corn or soybean yields relative to Systems 2 and 3. Spelt yields were increased by the higher fertility inputs in System 1. This is interesting since organic grain growers in New York tend to use manure in addition to plowed down legumes for corn production, but often rely on residual fertility for their winter grains. Soybean yields tended to be similar to conventional yields even during transition, indicating that soybeans are a good crop for the transition years. Net profits were lower for organic systems than for conventional during transition when the crops would have had to be sold as conventional produce, but the price premium and improved yields made all the organic systems highly profitable after transition.

Regular Talks – Soils/Farms

45. Influence of Soil Properties on Riparian Soil Phosphorus Availability

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Phosphorus (P) associated with stream bank erosion is thought to be an important P source in some Lake Champlain Basin watersheds. The objective of this study was to characterize the spatial variability of soil P and related properties at a riparian site along the Rock River in Franklin County, Vermont. Soil samples were systematically taken from a 10 hectare riparian area in 2008. At each of 71 locations, four depth intervals (0-15, 15-30, 30-45, and 45-60 cm) were sampled and analyzed for total P, Modified Morgan extractable P (MM-P), and particle size. Results showed that imperfectly drained areas had greater total and MM-P compared to the better drained soils. Total and MM-P concentrations varied by soil series and showed significant spatial variation at each sampling depth. Particle size was not well correlated with soil P concentrations. The quantity of MM-P reported depended on whether it was defined as that measured by molybdate colorimetry or inductively coupled plasma spectroscopy (ICP). MM-P measured by ICP was 70% greater on average than MM-P measured by molybdate reaction. Soil organic matter was highly correlated with the difference in P concentrations between the methods, suggesting the importance of soluble organic P in the soils. Results highlight the importance of soil genesis on P concentrations at this site.

46. Arsenic and Lead Uptake by Vegetable Crops from Old Orchard Soils

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Pesticides of lead and arsenate were used extensively from the 1890's until the mid-20th century to control insect pests in fruit orchards. These toxic metals accumulated in the topsoil and have persisted due to low mobility. Because apple orchards were relatively commonplace on farms in the Northeastern US, soil contamination by these metals may be encountered as agricultural land is converted by development into yards and gardens. The potential for As and Pb uptake into food crops is considered to be low because of the soil-plant barrier; however, most of the crop analyses supporting this generalization were done some time ago by relatively insensitive analytical methods that may not have properly quantified Pb and As in vegetable crops. The study reported on here revisits the question of Pb and As availability in old orchard soils, testing uptake of these metals into a leafy vegetable (lettuce) and a root crop (carrots). Soils with a wide range of Pb

(17 to 915 mg/kg) and As (<10 to 211 mg/kg) contamination were collected from an old apple orchard near the Cornell University campus, and used in a replicated greenhouse pot experiment. Uptake of Pb and As by the edible portion of each crop grown in the greenhouse was measured by digesting the harvested tissues in acid and analyzing the digests using ICP- MS. The relationships of vegetable Pb and As concentrations on soil concentrations of these metals are reported here. Preliminary micro-X-ray fluorescence (μ -XRF) investigations of the spatial distribution of Pb and As in the orchard soils showed these two metals, along with Ca and S, to be closely associated at high concentrations in particles several microns in diameter. The chemical form of Pb in old orchard soils appears to be different from that observed in most urban Pb-contaminated soils.

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47. Managing Fertilizer to Reduce Nitrous Oxide Emission in Eastern Canada

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Nitrogen fertilizer use has been shown to increase emission of nitrous oxide, a gas putatively implicated in climate change and stratospheric ozone depletion. However, continued nitrogen inputs are also considered essential for supporting foreseeable demand for cereal grains. Management practices that reduce emissions while supporting increased yields need to be specified in protocols to qualify as offsets in carbon trading schemes, and as ecological goods and services. A meta-analysis was conducted of more than 30 published Eastern Canadian studies in which nitrous oxide emissions were measured in response to application of nitrogen fertilizer. The objective was to identify specific combinations of source, rate, timing and placement optimizing crop yield per unit of nitrous oxide emission. The findings to be presented are to be incorporated into a protocol to suit the requirements of existing and anticipated regulatory mechanisms facilitating the trading of carbon credits.

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48. Reducing Phosphorus Runoff from Small Livestock Farms into Missisquoi Bay

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[1]Bourdeaus' and Bushey, Inc., and [2]UVM Extension

In 2007, a two-year project was initiated to develop site-specific Nutrient Management Plans (NMP) for 30 Small Farm Operation (SFO) to reduce phosphorus runoff within the Missisquoi Bay watershed in Vermont. The project was funded through a US federal appropriation to the International Joint Commission (IJC), US Section, and implemented by the Lake Champlain Basin Program (LCBP) and New England Interstate Water Pollution Control Commission (NEIWPCC). The objective was to document changes in potential phosphorus loss from agricultural lands through voluntary development and implementation of a standardized NMP based on the USDA Conservation Practice Standard no. 590 - Nutrient Management. The 2008 and 2009 NMPs were presented to each farmer for their use in planning management changes. Reductions in phosphorus loss were evaluated by the Phosphorus Index (P-Index) scores for 385 individual crop fields (1,734 ha). Phosphorus loss reduction was calculated as the difference between actual P Index scores in 2008 when changes in farm practices could be implemented and the scores from practices outlined in the 2008 Nutrient

Management Plans. The Total P Index score average for all farms decreased by 9.3% from 54.1 in 2007 to 49.1 in 2008. The sediment-bound P Index score was reduced by 11.9% (from 18.8 to 16.6) while the dissolved P Index portion of the total score was reduced by 7.9% (from 35.3 to 32.5). The overall reduction in total P-index scores was equal to one-half of the potential reduction of 19% which could have been achieved if the 2008 nutrient management plan had been strictly followed by all farmers. Similar reductions in P Index scores were shown in the 2009 NMP provided to each participant farmer.

49. Potassium (K) Fertilization of Alfalfa-Grass: How Much do we Really Need?

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Though potash prices have softened in recent months, record high potash prices combined with record low milk prices in the past couple of years caused dairy producers to question the need for K application on alfalfa-grass stands. Two studies were initiated to determine the impact of K application on alfalfa (*Medicago sativa* L.) yield and soil test K over time. In the first experiment, a K rate study was superimposed on 2nd year alfalfa plots using 5 rates (0, 93, 186, 286 and 375 kg/ha of K_2O, up to 1 1/3 times estimated crop removal). At the start of the study, the soil test averaged 55 mg/kg Morgan K which was classified as high in K for this silt loam soil. After three years in a 3-4 cut system, accumulative alfalfa yield averaged 30.9 Mg/ha dry matter (DM) with no significant differences among the five K treatments indicating that K availability did not limit yield. Morgan soil test K decreased with K application rates below 2/3 crop removal, remained constant with 2/3 crop removal and increased with high applications. In the second study, K treatments (0 versus 235 kg/ha K_2O in four replications) were established in 16 alfalfa-grass fields of varying soil test K levels on two dairy farms in Central New York. Potash was applied after first cutting and 2nd, 3rd and 4th cut yields were determined. The results suggested a critical agronomic soil test K of 60 mg/kg Morgan K across all 16 fields. Soils testing below this critical agronomic value showed a significant yield response of 0.7 Mg/ha DM versus no response to extra K beyond this agronomic critical value. Both projects are continued in 2010 and the latest findings will be presented.

50. Nutrient Management Planning for Small Farms in the New York City Watershed

Dale Dewing
Cornell Cooperative Extension of Delaware County

Livestock manure is one of the largest potential sources of nutrient enrichment for the reservoirs in the New York City drinking water supply. The New York City (NYC) water supply system is one of the largest surface water storage and supply systems in the world. The system reliably delivers more than 1.1 billion gallons of safe drinking water daily to nine million people – this represents nearly half the population of all New York State. The Watershed Agricultural Program Nutrient Management Team (NMTeam) develops and supports implementation of effective NMPs for approximately 250 farms, of all sizes, in the NYC watershed. We have developed a planning protocol and format enabling an NMP to meet all standards and requirements while being quick and easy to interpret. All important information needed to identify manure rate, timing and application restrictions can be viewed on a laminated aerial photo map that can be easily interpreted by farm managers and employees. These procedures have been specifically developed for the conditions and practices of small farms in the Catskill Region. The NMTeam, in cooperation with Cornell Cooperative Extension, annually provides targeted workshops to keep farms up to date on current issues related to crop production, crop fertility, soil health and environmental losses of nutrients. The Watershed Agricultural Council's Nutrient Management Credit program encourages heightened stewardship of manure resources by implementing an incentive for farmers to follow their NMP closely on a daily basis. The nutrient management program is carried out through partnerships with County Soil and Water Conservation Districts, USDA Natural Resource Conservation Service, and funding by the New York City Department of Environmental Protection.

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51. Chesapeake Bay Issues: The Junction of Science and Policy

Dave Hansen
University of Delaware

There are a number of new initiatives to address water quality issues in the Chesapeake Bay. These initiatives range from an Executive Order in 2009 to a new, Bay-wide Total Maximum Daily Load that will be completed in 2010. Since the Chesapeake Bay watershed includes parts of six states and the District of Columbia, it is critical that new policies are based on sound science. This is often a challenge. This presentation will provide an overview of policy interact in this important watershed.

52.Managing Nutrients on Dairy Farms Through Feed Management

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Most dairy farms import more nutrients onto the farm in inputs than they export in product, resulting in a farm mass nutrient imbalance and net accumulation of nutrients on the farm, where they then can be subject to loss to the environment. The largest source of imported nutrients is purchased feed, accounting for two thirds or more of all imported nutrients. Over the last five years, Cornell Cooperative Extension of Delaware County has been developing and implementing a unique program that works with dairy farms to make them more economically and environmentally sustainable through management of homegrown feed production and dairy cattle rations. Through a three pronged approach of on-farm planning, education, and research and development, this program helps farms reduce purchased feed imports, manure nutrient excretions and farm nutrient accumulations while improving farm profitability. To date the program has reduced farm nitrogen and phosphorus accumulations 35 and 53%, respectively, and manure nitrogen and phosphorus excretions by 23 and 11.5 lbs per cow per year, respectively. Economic analysis of farms in the program show on average they produced 1400 lbs more milk per cow per year and had operating expenses that were $1.33 per hundredweight lower than similarly sized farms not participating in the program. In an effort to help farmers implement more timely and cost effective crop production, the program has successfully implemented a county wide no-till initiative to help farmers successfully adopt no till crop production methods resulting in over 30 farms adopting no till and nearly 1000 acres of not till annually in the county. The program is also implementing a pilot small grain production initiative to assist producers in production, processing, and utilization of small grains for on farm use.

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53. Evaluation of Farm Performance Indicators of Three New York Dairies as Predictors for Farm Nutrient Balances over Time

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Annual farm-gate nutrient mass balances (NMBs) are important tools for farm managers and policy makers alike. Nutrient Mass Balances can be used on-farm to identify opportunities to increase production efficiency, monitor progress over time and as a method for gauging a sustainable balance between livestock production systems and their land base. The objective of this study was to evaluate multiple within-farm indicators from different data sources for their ability to reflect management changes on farms that lead to reductions in NMBs. Three dairy farms were monitored for five years (annual data collection). Animal densities of the farms, adjusted for manure exports, ranged from 0.89 to 1.37 animal units (AU) per acre. The NMBs were calculated as the difference between nutrient imports (feed, fertilizer, animals and bedding) and exports (milk, animals, crops, manure), expressed on a per acre and a per cwt basis. Manure and crop records were combined with the farm-gate balance data to calculate within-farm agricultural environmental performance indicators. All three farms showed a decrease in NMBs over time; nitrogen (N) balances decreased by 40-62%, phosphorus (P) by 48-85%, and potassium (K) by 46-65%. Adjusted animal density decreased 9-16% largely due to increases in manure exports. Feed use efficiency for N ranged from 15-18% in year one and 18-20% in year five while whole farm N production efficiency increased from 24-30% in year one to 32-51% in year five. Similar changes were observed for P and K. Reductions in adjusted animal density, N, P and K fertilizer use, and purchased feed nutrients, and an increase in feed use efficiency contributed to the decreases in NMBs and all are important agricultural environmental indicators for monitoring and evaluating farm management strategies.

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54. Sulfur Needs of Alfalfa; Tools for Sulfur Management

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Alfalfa is an important forage crop in New York State (NY). Over the past decades, atmospheric S deposition has decreased, raising questions about the S status of alfalfa. On-farm S response trials were conducted in eight locations in NY, comparing two S sources ($CaSO_4$ and $K_2SO_4 \cdot MgSO_4$ at 150 lbs S/acre applied after 1st cutting in 2008) versus a no-S control in four replications. Forage quality and yield were monitored for two years following the application. Soil samples (8 inch depth) were taken prior to applying treatments in 2008 and in early spring in 2009. Tissue samples (top 15 cm) taken at 3rd cutting were analyzed for total S. Estimates of milk per ton were calculated using Milk2006. In

2008, four sites with <0.25% tissue S were responsive to S addition while three sites with tissue S levels >0.25% were non-responsive. One site had a tissue S level <0.25% but was non-responsive to additional S, most likely due to the low pH of the site. Sulfur addition increased tissue S in both years. In 2009 only one site had significantly higher total yield where S has been applied, and all sites showed tissue S levels that had dropped below 0.25% in both the treated and untreated plots. Milk per ton estimates were not impacted by S addition. Soil test results showed that soils with $CaCl_2$ extractable S of 15 lbs/acre or less might benefit from S addition. We conclude: (1) there is a potential for a yield response upon S addition to alfalfa in NY, (2) tissue testing is effective in identifying S deficient sites (<0.25% S) for sites that are otherwise managed optimally (correct pH), and (3) a soil test of <15 lbs/acre indicates the probability of a response to S addition.

55. Energy Crop Anaerobic Digestion

Curt A. Gooch, P.E., Cornell University, PRO-DAIRY Program

Anaerobic digestion of energy crops (fermented corn silage and haylage) is common practice in Germany and other some other European countries and has the potential to contribute measurably to renewable energy goals in the United States. The powerpoint presentation will provide an overview of energy crop digesters, how much energy they can produce per unit mass of feedstocks, and options for energy utilization. Information will also be presented on the nutrient phase transformation of feedstock materials during the digestion process.

56. Manure Value/Cost Calculator

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Manure is commonly used on livestock farms as a readily-available, low-cost substitute for fertilizer. Fluctuating fertilizer and fuel prices, as well as environmental regulations, have highlighted the need for critical assessment of manure management costs and benefits. Increasing animal densities and labor and regulatory constraints on manure applications require livestock producers to consider alternative manure management strategies such as export of manure, contracting with custom-applicators for manure handling, and field allocation of manure based on soil test results and environmental risk assessment. A management tool was needed to compare manure management scenarios. In this study, we developed a Microsoft Excel ™ spreadsheet to answer these questions: (1) what is the break-even hauling distance for manure?; (2) what are the operating and ownership costs for manure handling equipment?; (3) what is the fertilizer replacement value of the manure (N, P and K, and handling cost of exporting manure?; and (4) how much time (machinery and labor) will it take to spread manure? The calculator allows for quick estimates of manure spreading costs using different manure spreading strategies at the whole farm and field levels. By changing the type of equipment, cost of equipment, labor requirements, manure nutrient densities, manure application methods, fuel costs and fertilizer costs, different scenarios can be created to represent various manure allocation options. Because manure nutrient ratios are unlikely to exactly meet crop needs, manure is valued “as applied” and “as currently needed”. The calculator is valuable for the individual producer trying to select where to apply manure for the greatest return, the producer who is trying to decide on export options, and the custom operator making pricing and capital investment decisions. The calculator is not a substitute for whole farm planning and nutrient budgeting.