The use of sand for bedding has been a great stride forward in the quest to make cows as comfortable as we can for production and animal well being reasons. Dealing with the manure-sand mix that comes out of the barn is the dark side of this management practice.

To recycle sand you can pay for an expensive separation and reclamation system or try sand lanes and tempt our frosty winter temperatures that challenge manure processing at times. If you can source close and cheap sand, direct land application makes sense. If you are a CAFO and need to store sandy slurry in a lagoon, now you start rethinking cow comfort versus the task of cleaning out settled sand at the bottom of the pit! For sand conventional tractor powered “stir sticks” do not effectively agitate enough area and in fact tend to separate sand out of the slurry suspension depending on the particle size.

Loading out 8 feet of built up sand from your lagoon is not a small or inexpensive proposition. Getting that stuff evenly distributed over cropland can be an exercise in wishful thinking. Even though it may be difficult to significantly alter the soil characteristics with lots of sand if spread out, piling it where convenient or practical and then dozing it around probably has localized impact.

Continued on page 3
Mission Statement
The NWNY Dairy, Livestock & Field Crops team will provide lifelong education to the people of the agricultural community to assist them in achieving their goals. Through education programs & opportunities, the NWNY Team seeks to build producers’ capacities to:

- Enhance the profitability of their business
- Practice environmental stewardship
- Enhance employee & family well-being in a safe work environment
- Provide safe, healthful agricultural products
- Provide leadership for enhancing relationships between agricultural sector, neighbors & the general public.

Ag Focus
Cornell Cooperative Extension of
Genesee•Livingston•Monroe
Niagara•Ontario•Orleans•Seneca
Wayne•Wyoming•Yates

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By law and purpose, Cooperative Extension is dedicated to serving the people on a non-discriminatory basis.

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Recently, Baker Brook Dairy of Attica, NY leased a “manure boat” from Jerry Stockman of Hy-Light Farm based in Adams Center, NY. This unit manufactured by Puck Custom Enterprises is officially known as a “PCE agitator boat”. These units come in various horsepower and pump capacities. Fully remote controlled, they provide powerful, vertical, jet agitation of lagoons bringing solids off the bottom into suspension while crisscrossing the surface. Fuel consumption is remarkably low, less than 6 gallons per hour. The agitator boat conveniently travels behind a pickup on a trailer and can be easily dragged on its tubular under frame. It also features a connection to directly empty the lagoon to tankers or via drag hose.

Jerry Stockman faced an almost 10 foot thick sand base in his lagoon a few years ago. He purchased the agitator boat for less than he was quoted by a contractor to remove and dispose of the sand. Luckily, he did have the 3 feet of liquid over the solids necessary to operate the pumping system. After a few pit emptying events, almost all of the built up sand was gone. Regular use of the boat at spreading time keeps ahead of any build up. Organic solids are no match for this rig, but long fibrous material will clog the pump.

Ed Ziegler of Baker Brook says that they are quite happy to be able to lease the unit until they can order one for themselves next year. Combine that with the number of interested visitors who came by to look and it won’t be long before Mr. Stockman’s machine is not the only one in New York State!

For more information go to http://www.puckenterprises.com/AgitationBoats.html
CCE - Genesee Co., in collaboration with Genesee Valley Educational Partnership, will be offering a CDL Training Program for both Class A and Class B licenses to Genesee County Ag producers and their employees.

This training program is designed for producers and farm employees who have some experience with commercial truck operation.

Attend an informational meeting on February 7th at 7:30 p.m. at the CCE Building located at 420 E. Main St. in Batavia. This meeting will answer any questions you may have about the program and pick up the required training materials and medical forms.

Classroom training dates will be February 12th and 13th at 7:30 p.m. Class will be held at the CCE building located at 420 East Main Street in Batavia.

To register contact Jan Beglinger at 585-343-3040 x 132 or jmb374@cornell.edu prior to February 6. The cost for Class A is $625.00 and the cost for Class B is $475.00.

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Increasing Milk Production with Energy Efficient Lighting

By: Jackson Wright

As we approach the shortest days of the year the seasonal changes in daylight become more noticeable. This presents an opportunity for dairy producers as increasing light exposure in dairy cows has consistently produced an increase in milk production of about 5 pounds per cow per day. This lighting regimen is known as long-day photoperiod or LDPP. Currently it is thought that LDPP suppresses the release of melatonin, which increases the release of prolactin and insulin-like growth factor I - both of which are associated with improved mammary function. However, it can be challenging to properly implement LDPP on commercial dairy farms. For instance, lactating cows need to be exposed to 16 to 18 hours of light followed by 6 to 8 hours of uninterrupted darkness. In addition, lights need to be strategically placed so that all areas of the barn achieve a minimum light level of 150 lux at cow eye level. This often requires assistance from a lighting engineer to determine if the fixtures selected can achieve the specified light levels based on size of the barn, number of fixtures, light output per fixture, and mounting height.

Common light fixtures found on dairy operations are T8 fluorescent, metal halide, high pressure sodium, and more recently, light emitting diode (LED). Each fixture has a unique set of benefits and drawbacks. For instance, fluorescent lights are energy efficient and usually pay for themselves within 2 years of installation. On the other hand, fluorescent fixtures require maintenance, perform poorly under cold or hot conditions, and contain mercury which could be disastrous should a bulb break around lactating cows. High intensity discharge (HID) fixtures provide ample light at ground level when ceiling heights are greater than 12 feet. However, these fixtures require a long pre-heat or start-up time. Finally, LED lights can provide high energy efficiency with a reported 100,000 hour operating life. This is significantly longer than the reported 20,000 hour operating life of fluorescent and HID fixtures. Moreover, LED lights are expected to have lower maintenance costs, contain no mercury, and provide instantaneous reliable light, though LED fixtures are expensive when compared to the other fixtures.

These unique attributes can make it confusing to select fixtures best suited for dairy operations. However when considering implementing LDPP, LED fixtures may provide an edge. Consider this: lighting performance is often measured based on lumens/watt. This can be misleading for dairy producers because lumens represent effective light for the human eye. Dairy cows perceive light differently than humans meaning a light fixture can provide ample lumens/watt, but may not provide light in the appropriate spectrum to stimulate milk yield. For instance, high pressure sodium fixtures provide high lumens/watt; however light output from these fixtures is biased towards longer wavelengths which cows cannot perceive. Fluorescent fixtures provide ample effective light for the cow; however under cold conditions light output of fluorescent fixtures can decrease by more than 40%. Cold conditions would be typical of most barns during the winter months, precisely when supplemental lighting from light fixtures would be required. LED fixtures can provide light in the same spectrum as sunlight and are more reliable under cold conditions. These two considerations suggest LED fixtures may be best suited for implementing LDPP; however this scenario needs to be investigated under barn conditions.

Currently, Pro-Dairy is conducting a study investigating the cost benefits of LED lighting systems and T8 fluorescent lighting systems on dairy operations. This study will account for the initial cost of the fixtures, fixture performance, operating life, expected energy savings, and milk production to determine which lighting system is the most cost effective for dairy producers.
The annual corn and soybean yield contest is sponsored by the New York Corn & Soybean Grower Association. There were 67 yield entries submitted for both the corn and soybean contests this year. There were some fantastic yields this year! The top regional and state winners will be presented awards at the 2013 NY Corn & Soybean Expo in Syracuse on January 24th.

**Corn Contest Regional Winners**

**Western Region**

1. Matt Kludt  Orleans County  DeKalb 46-20     278.73
2. Matt Kludt  Orleans County  DeKalb 49-94     260.25
3. Bret Meyer  Livingston County  Pioneer 891AM1    248.47

**Finger Lakes Region**

1. Eric Lyon  Seneca County  Pioneer 216HR     268.85
2. Charles Campbell Tioga County  DeKalb 53-45     267.21
3. Eric Lyon  Seneca County  Pioneer 216HR     258.90

**Central Region**

1. Bob Pawlowski  Oneida County  Pioneer 216HR     258.89
2. Jim Collins  Oneida County  Pioneer 216HR     232.88
3. Bob Pawlowski  Oneida County  Pioneer 35F48     217.51

**Overall NY State Corn Contest Winners**

1. Matt Kludt  Orleans County  DeKalb 46-20      278.73
2. Eric Lyon  Seneca County  Pioneer 216HR     268.85
3. Charles Campbell Tioga County  DeKalb 53-45     267.21

**Soybean Contest Regional Winners**

**Western Region**

Group 1 Brad Macauley Livingstone County  NK 1097     75.97
Group 2 Myron Brady Livingston County  Pioneer 92Y51     85.02
Group 3 No Entries

**Finger Lakes Region**

Group 1 Scott Arliss Wayne County  SG1711     80.02
Group 2 Bill Tack Wayne County  SW2111     83.94
Group 3 Todd DuMond Cayuga County  Pioneer 93M11     79.99

**Central Region**

Group 1 Humphrey’s  Oneida County  Pioneer 91Y90     63.31
Group 2 Kevin Sykes  Oneida County  Pioneer 92Y31     71.97
Group 3 Bob Pawlowski  Oneida County  Pioneer 93Y22     64.83

**Overall NY State Soybean Contest Winners**

1. Myron Brady  Livingston County  Pioneer 92Y51     85.02
2. Bill Tack  Wayne County  SW2111     83.94
3. Bret Meyer  Livingston County  Pioneer 92Y91     82.73
Farmers and ranchers in New York will soon have the opportunity to make a positive impact on their communities by taking part in the 2012 Census of Agriculture. Conducted every five years by the U.S. Department of Agriculture’s (USDA) National Agricultural Statistics Service (NASS), the Census is a complete count of all U.S. farms, ranches and those who operate them.

“The Census remains the only source of uniform, comprehensive agricultural data for every county in the nation,” said King Whetstone, Director of the New York Field Office. “It’s a critical tool that gives farmers a voice to influence decisions that will shape the future of their community, industry and operation.”

The Census looks at land use and ownership, operator characteristics, production practices, income, expenditures and other topics. This information is used by all those who serve farmers and rural communities from federal, state and local governments to agribusinesses and trade associations. For example, legislators use the data when shaping farm policy and agribusinesses factor it into their planning efforts.

“Your answers to the Census impact farm programs and rural services that support your community,” Whetstone said. “So do your part and be counted when you receive your form, because there’s strength in numbers that only the Census can reveal.”

In 2007, farmers reported a total of 36,352 farms, spanning across 7.17 million acres. This shows a 2.4 percent decrease in number of New York farms from the previous Census in 2002. New York’s farms accounted for $4.42 billion worth of farm products sold in 2007. The leading counties for cash receipts in 2007 were Suffolk and Wyoming with $243 million and $225 million, respectively. This telling information and thousands of statistics are only available every five years as a direct result of farmer responses to the Census.

NASS will mail out Census forms in late December, to collect data for the 2012 calendar year. Completed forms are due by February 4, 2013. Producers can fill out the Census online via a secure website, www.agcensus.usda.gov, or return their form by mail. Federal law requires all agricultural producers to participate in the Census and requires NASS to keep all individual information confidential.

For more information, visit www.agcensus.usda.gov. The Census of Agriculture is your voice, your future, your responsibility.
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February 27, 2013
BW’s
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- Green of the Grass, Cliff Hawbaker, Chambersburg, PA
- Managing the Soil to Manage the Pasture, Bill Verbeten, NWNY Team
- Planning for Emergencies: Alternative Water Sources, Nancy Glazier, NWNY Team
- Economics of Grazed vs. Stored Feed, John Hanchar, NWNY Team
- Pasture Plant Planning, Bill Verbeten, NWNY Team
- Farm Planning, Beth Dahl, Harvest NY!

Pre-registration by: February 20
Cost: $35.00 first person, $25.00 for each additional person
To register contact:
Cathy Wallace: 585.343.3040 x138 or cfw6@cornell.edu
Questions??? Contact: Nancy Glazier: 585.315.7746

Soybean / Small Grain Congress 2013

Special Guest Speaker: Peter Johnson, Provincial Cereal Specialist,
Ontario Ministry of Agriculture, Food and Rural Affairs
Ontario’s wheat guru will explain the latest advances in wheat research for high management wheat.

- Soybean Varieties, Row spacing, Seeding rates, & Seed Treatments, Bill Cox, Cornell Agronomist
- Soybean & Wheat Disease Update, Gary Bergstrom, Cornell Plant Pathologist
- Herbicide Product Update for Weed Control in 2013, Russ Hahn, Cornell Weed Scientist
- Growing Malting Barley in NY, Bill Verbeten, Cornell Cooperative Extension, NWNY Team
- Aphids, Armyworms & other Insects of 2012, Mike Stanyard, Cornell Extension, NWNY Team

We will also look at the results and winners of the 2012 Soybean Yield Contest!
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February 7, Holiday Inn, Waterloo
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RESERVATIONS MUST BE RECEIVED BY: January 30, 2013
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eXtension categories include alerts, community, disaster issues, energy, family, farm, health and nutrition, lawn and garden, pest management and youth.

DAIReXNET, a subcategory of eXtension as an example, is provided by 10 dairy extension professionals from across the United States. Additionally, the subject areas are led by 13 dairy experts from across the country. Two hundred and seven dairy professionals representing 35 universities and allied industries and including the top 25 dairy states participate. Many activities, articles and webinars (upcoming and archived) are available in this section.

**Upcoming webinars:**

**Potential and Pitfalls for Genomic Selection**

**January 14, 2013**

12:00-1:00 PM Central Time

Dr. Chad Dechow, Pennsylvania State University

Join us for this session to hear Dr. Dechow review genomic technology and implementation, comparisons of early genomic predictions to actual daughter proofs, a discussion of inbreeding, and how genomics can be used as a herd management tool.

**Better Milk Quality from Better Mastitis Therapy Decisions**

**February 12, 2013**

12:00-1:00 PM Central Time

Dr. Ron Erskine, Michigan State University

Mastitis is one of the biggest chronic problems facing the dairy industry— it is ever present. In this session, Dr. Ron Erskine will discuss how to better identify cases of mastitis through tools such as milk culturing, somatic cell count records, and treatment records.

**Far Off to Fresh Cow—Opportunities to Improve Transition Performance**

**March 18, 2013**

12:00-1:00 p.m. Central Time

Dr. Mike Overton, Elanco

A successful lactation starts well before calving. Going back to the completion of her previous lactation and entry into the far dry cow pen, how we manage and feed the cow well before she approaches calving contributes to the likelihood of her achieving a high level of milk production and conceiving in a timely manner. This presentation will “walk” through the opportunities and challenges in the far dry, close-up, and fresh pen, including nutritional and housing management, and discuss a few of the key monitoring approaches for evaluating performance.
Taking Forage Inventories

By: Bill Verbeten

Planning ahead is vital to avoid or at least reduce the impact of the coming feed shortages in the next few months. With the poor haylage harvests across western New York this past summer there is a lot of concern about having enough feed to make it through the winter on a lot of farms. It is very important to determine how long feed will last now while many management options are still on the table. Once an inventory is taken, adjustments can be made to get the most out of silages and hay on hand. Farms that had timely rainfalls and reasonable yields this past year can also benefit from knowing how much feed they have on hand. Selling extra feed will provide additional income and also help other farmers across the region meet their needs.

Preliminary silage inventories can be taken while filling silos by recording wagon weights and dry matter content. With good management, silage storage losses are generally ≤ 10% DM and feed out losses are ≤ 3% DM. Minimizing the area of silos exposed to air and feeding out at least 4 inches a day can keep these combined losses from climbing to 20-50% DM loss. If silage weights were not taken prior to storage, measurements of silage dry matter, volume, and bulk density will be necessary to determine feed inventory.

DM% * Feed Volume * Bulk Density = Forage DM Inventory

Dry matter content is given on most forage quality lab analyses and this measurement can be done on farm with an NIRS unit, a Koster tester, or even a microwave to account for weekly, or even daily dry matter variation with precipitation.

To calculate the feed volume in bunker silos, separate the rectangular and triangular sections. The feed volume of upright silos and silo bags can be calculated in one step. For feed volume equations see Figure 1.

Figure 1: Feed Volume Equations Based on Different Silo Shapes

For upright silos and silo bags the radius is half the length across the silo base or bag face.

Bulk density measures how tightly the feed material is packed. Higher bulk density means more material in a given volume.

The bulk density of most silages range from 10 to 20 lbs DM/ft³, with about 14 lbs DM/ft³ considered ideal, approximately 40 lbs As Fed/ft³. Measuring is necessary to determine an accurate bulk density. One method for measuring bulk density is the following: drill with a 12+ in probe into the face of the bunker or bag in at least a dozen locations, dry and weigh the feed, then divide the total dry weight by the volume sampled. However, drilling with a probe is time consuming, can be dangerous, and the accuracy can be compromised if the whole silo face is not represented by the sample locations.
Bulk density is more commonly measured by taking the load weights multiplied by silage DM% then dividing by the volume of feed removed. Accurate measurements of silage DM% and load weights, evenly facing the bunk/bag, and correctly calculating the volume removed are vital to making this method of bulk density work. Bulk density is not consistent in vertical silos, because the bulk density is greater at the bottom of the silo (~21 lbs DM/ft³) compared to the top of the silo (~7 lbs DM/ft³).

For every silage structure, multiply the dry matter, volume, and bulk density to determine the amount of feed on the farm.

Dry hay inventories should also be taken by multiplying the average DM% from a group of bales with the average bale weight and the number of bales.

Once forage inventories are taken, the rate of feed removal needs to be determined. If silage and hay are weighed on a daily basis, then the daily forage removal = total forage weight fed * forage DM%. For farmers who don’t weigh their forages directly, daily forage removal can be estimated by multiplying the DM weight of each forage fed to each animal by the number of animals for each feeding group.

Remaining forage/daily forage removal = days of forage remaining. Once this is known, management decisions can be made in order to avoid running out of feed. For discussion of forage inventory management see my blog at http://billsforagefiles.blogspot.com/.
By: Libby Gaige

**Heat Detection**

Watching cows for heat is a task that’s often assigned to cow pushers, since they probably spend more time observing cows than anyone else on the dairy. They also spend time among cows during the night hours, when cows in heat tend to be most active. While their primary job is bringing cows to the parlor, they should understand just how important heat detection is.

Heat is the time period in which a cow can become pregnant if she is inseminated. It lasts from 6 to 30 hours, and the best time to breed is during the 12 hours of “true heat”. If we waste an opportunity to breed a cow, we’ll have to wait 21 more days until the cow cycles into heat again. It’s easy to waste many months in this way! On the other hand, breeding a cow that isn’t in heat is a waste of semen.

There are many signs to help identify a cow in heat. The surest sign that a cow is in true heat is that she allows other cows to mount her. The secondary signs are shown sometimes by cows in true heat, but also when a cow is entering or leaving true heat. Some of these secondary signs are dirty flanks and a red and inflamed vulva with a clear mucous discharge. Cows in heat will also sniff the vulvas of other cows, bawl like a bull, walk faster, ride other cows, and give less milk than normal. The possibilities that a cow inseminated while entering or leaving true heat will become pregnant aren’t very good, so it’s worthwhile to pay close attention to cows that may be in heat.

**Detección de Celo**

Buscar vacas en celo es un trabajo muchas veces asignado a los arreadores de vacas, como ellos pasan más tiempo observando a las vacas que cualquier otra persona en la granja. También pasan mucho tiempo con las vacas durante la noche, cuando las vacas en celo están más activas. Aunque su trabajo principal es llevar las vacas a la sala de ordeño, es importante que entiendan que tan importante es identificar las vacas que están en celo.

El celo es una temporada en que una vaca puede quedarse preñada al inseminarla. Solamente dura unas 6 a 30 horas, y hay unas 12 horas en que es más recomendable inseminarla (el celo verdadero). Si gasta- mos una oportunidad para inseminar una vaca, tendremos que esperar 21 días hasta la vaca cicla al celo otra vez. ¡Así es posible gastar muchos meses! Al contrario, inseminar una vaca que no está en celo sería una pérdida de semen.

Hay varios signos para ayudarnos a identificar una vaca que está en celo. El signo más seguro del celo verdadero es que la vaca se deja montar por otras vacas. Los signos secundarios están mostrados a veces por vacas en calor verdadero, pero también cuando están entrando o saliendo del celo verdadero. Algunos de estos signos secundarios son los flancos sucios y una vulva rosada, inflamada y con una descarga de moco claro. Las vacas en celo también suelen olfatear la vulva o la orina de otras vacas, vociferar como un toro, caminar más rápido, montar a otras vacas y dar menos leche que normal. Las posibilidades de que una vaca inseminada cuando está entrando o saliendo del celo quedaria preñada no son muy altas, así que vale la pena poner mucha atención a las vacas que podrían estar en celo.

---

**Heat Detection – Detección de Celo**

Look for cows in heat - Busque vacas en celo

The vulva is red and swollen – La vulva está rosada e inflamada

The vulva has a clear mucus discharge - La vulva tiene una descarga de moco claro

The cow allows other cows to mount her - La vaca se deja montar

Sniffs vulva of other cows – Olfatea la vulva de otras vacas

Bawls like a bull - Vocifera como un toro
FOCUS ON FORAGE

With the widespread drought across much of the Eastern and Midwestern parts of the United States, forage quality and quantity are going to be a concern for 2012 and 2013. Corn yields for silage are predicted to be low, with small and reduced numbers of ears. Maximizing milk production with low starch corn silage will be a matter of maximizing fiber digestion in the rumen and getting the most out of your forage.

The rumen is a large fermentation vat (40 to 60 gallons in a mature dairy cow) that contains microbial populations of bacteria, protozoa and fungi. These microbes produce enzymes that digest fiber, starch, and protein into glucose and ammonia to fulfill a majority of the cow’s requirements for energy and protein. The main fuel source for these rumen microbes is fiber from forage, and maximizing microbial activity will maximize forage utilization.

In order to function, rumen microbes require protein and energy. Not only do the microbes require a sufficient amount of protein and energy, they require a consistent supply of these nutrients to power them throughout the day. A typical dairy ration will provide the microbes with energy in the form of quickly degraded starch and more slowly degraded fiber to provide a complete profile of energy sources. To match the supply of energy, you need a protein source that will supply nitrogen to the rumen microbes at a consistent rate.

Optigen™ is a slow-release nitrogen source that meets the nitrogen needs of the microbes without over- or undersupplying nitrogen. It is critical to give the microbes the nutrients they need to maximize forage digestion. Shorting the rumen of nitrogen will result in more undigested feed leaving the rumen and ending up in the manure.

Another way to assist fiber digestion is to supplement the microbe’s natural enzymes with an enzyme source in the feed to increase the rate of fiber digestion as well as the amount of fiber digested in the rumen. Fibrozyme™ is a fiber degrading enzyme that works especially well with corn silage, even when it is poor quality. By increasing the rate of digestion, we can effectively improve the quality of forage that has been drought stressed by getting more energy out of the fiber.

Both of these technologies, Optigen™ and Fibrozyme™, not only maximize rumen function and forage utilization, but can give farmers flexibility in ration formulation. With limited supplies and high cost of both forages and corn grain, we can include more underused and undervalued feedstuffs. Feeds like citrus pulp, distillers grain, and wheat midds, which are typically fed at low levels in the ration, can be used to replace a portion of forage and grains. We can get more out of these by-product feeds by ensuring the rumen microbes have the nutrients to perform at their best and supplementing their natural enzymes.

The Alltech Dairy Advantage program is the natural way to improve your dairy herd health and performance while increasing your profitability. To learn how the Alltech Dairy Advantage program can help you, please contact your local Alltech representative or email dairy@alltech.com.

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January, 2013

22-23 Academy for Dairy Executives, Country Inn & Suites, 130 N. Main St. Mt. Morris. For more information contact: Joan Petzen 585.786.2251 x122 or jsp10@cornell.edu

February 2013

5 Strategic Marketing for Livestock Producers, 6:30-8:30 p.m., CCE-Orleans Co. 12690 State Route 31, Albion, Cost: $30 per farm (up to 2 people). Registration: Kim Hazel 585.798.4265 x26 or email: krh5@cornell.edu

6 WNY Soybean/Small Grains Congress, 9:00 a.m.—3:00 p.m., Clarion Hotel, 8250 Park Road, Batavia. DEC credits pending. For more information contact: Cathy Wallace 585.343.3040 x138 or cfw6@cornell.edu

7 Finger Lakes Soybean/Small Grains Congress, 9:00 a.m.-3:00 p.m., Holiday Inn, 2468 NYS 414 Waterloo. DEC credits pending. For more information contact: Cathy Wallace 585.343.3040 x138 or cfw6@cornell.edu

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21 Lambing & Kidding Workshop, 6:30-9:00 p.m., CCE-Ontario Co. 480 N. Main Street, Canandaigua, Register: Nancy Anderson 585.394.3977 x427

March, 2013

12-13 Academy for Dairy Executives, Beaver Hollow Resort & Conference Center, 1083 Pit Road, Java Center. For more information contact: Joan Petzen 585.786.2251 x122 or jsp10@cornell.edu

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