

**2014 Northeast Pasture Consortium Poster Paper Abstracts  
February 4 & 5, Ramada Conference Center & Golf Hotel, State College, PA**

**Equine Pasture Management**

**Equine Pasture Management and High Density Grazing Demonstration**

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**Penn State's Ag Progress Days:**

- Russell E Larson Agricultural Research Center, Rock Springs, PA - largest annual outdoor agricultural exposition. 3 day event - demonstrations, exhibits, food stands.
- 2013 - 493 exhibitors, public attendance over 46,000 (Tuesday-12,000; Wednesday-24,000; and Thursday-10,000) ([http://agsci.psu.edu/apd/about/attend\\_figures](http://agsci.psu.edu/apd/about/attend_figures)).
- Site covers: 80+ acres-crops, machinery demonstrations, 55 acres indoor and outdoor exhibits.

**2013 Featured a Live Pasture and Grazing Demonstration**

- Partnership: Penn State, agencies, businesses and farmers educating farm operators in Best Management Practices (BMPs) and environmental stewardship.
- Technical partners: PSU College of Agricultural Sciences and Extension, PA Grazing Lands Coalition, Capital RC&D, USDA Natural Resources Conservation Service (NRCS) & Agricultural Research Service (ARS).
- PA businesses contributing to site construction elements: Allensville Planing Mill, Evergreen Fence, Kencove Farm Fence Supplies, Perry Pipe Supply, Seedway LLC and AgriCulver Seeds.
- Highlighted specific conservation practices related to pasture usage; featured Angus beef cattle and Quarter horses.

**Equine Pasture Management and High Density Grazing Tour**

- Observation and education concerning construction materials and technologies utilized in developing a paddock system and establishing forage areas as part of a pasture-based operation for livestock.
- Hands-on demonstrations: high density grazing and examples of open housing/confinement areas on pasture for equine.
- Methods used to harvest and maintain healthy forage pastures, education on plant and soil health.
- **Pasture Rainfall Simulator demonstration**, part of *Unlocking the Secrets of The Soil*, a USDA-NRCS initiative. Focus- improving soil health. Shows how quickly or slowly rain water infiltrates soil/forage samples taken from select fields using various pasture management techniques. Samples included three scenarios: livestock loafing areas, pasture with limited forage growth, and well-maintained high density pasture.

**Bob Oberheim, Ag Progress Days Manager**

“The development of the pasture and grazing demonstration area has truly been a partnership effort and will be a valuable educational experience for folks attending Ag Progress Days for years to come,” (<http://agsci.psu.edu/apd>).

- Self-guided tour or daily scheduled bus tours facilitated by technicians from USDA- NRCS and

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ARS, County Conservation District and PSU Extension Equine Team. Scientific-based education provided along with question and answer sessions.

<b>2013 Ag Progress Days Pasture Management and High Density Grazing Attendance</b>				
	<b>Tuesday</b>	<b>Wednesday</b>	<b>Thursday</b>	<b>Total</b>
10:30 AM	24	29	32	<b>85</b>
12:30 PM	23	42	24	<b>89</b>
2:30 PM	38	42	No tour offered	<b>80</b>
<b>All Times</b>	<b>85</b>	<b>113</b>	<b>56</b>	<b>254</b>

**Livestock Section**

- High density grazing demonstration focused on improving plant diversity, pasture condition, and soil health.
- Use of temporary fencing to rotate cattle in small areas for short periods facilitating better forage utilization.
- Enables pastures to regain higher forage growth, promoting microbial activity and nutrient cycling through trampled residue and manure, resulting in improved soil health over an extended period of time.
- Utilized pre-established fields with the following grass varieties: Orchardgrass, Timothy, Clovers, Fescue, and Kentucky Bluegrass. Designated area contained existing American Chestnut trees and high weed content.
- Included portable livestock watering trough, types of movable fencing materials - spools, insulators, and posts.

**Equine Section**

- Established two pastures through herbicide application and no-till drill seeding.
- Included constructed ACA (Animal Concentration Area), turn out shed, prepared base footing, watering system, manure storage area, and multiple gates providing access to pastures.
- Pasture One: planted in various strips of grasses for identification of specific differences in grass growth. Demonstrated varieties most desired by horses such as Kentucky Bluegrass, Tall Fescue, Orchardgrass, Clover, Timothy, Brome and Ryegrass.
- Pasture Two: planted with mixed pasture seed to provide visible effect of a true pasture.
- Results: Following planting, pastures experienced excessive rain followed by lengthy drought stifling growth. Technical facilitators utilized opportunity to educate on weather impact, forage identification, and weed competition.
- Evaluation - after event, pastures were over-seeded and re-established following the initial planting procedure. Spring 2014: research/documentation will be conducted on emerging forage growth, temperature, and rainfall effects on forage growth.

ACKNOWLEDGEMENTS: Technical and financial support provided by USDA-NRCS/ARS, PSU Extension, PA Grazing Land Coalition, Capital RC&D

**Keywords:** (BMPs) best management practices, rainfall simulator, stewardship, (ACA) Animal Concentration Area, and high density grazing

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**Profile of the Equine Industry's Grazing Best Management Practices in Pennsylvania**

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**Abstract:** Pasture is a good source of nutrition and 94% of the 9.5 million horses in the United States graze pastures nationwide. Proper management of equine operations requires the adoption of Best Management Practices (BMPs) to balance nutrient production and prevent erosion. Government agencies are concerned about non-point sources of water pollution and have focused on equine operations. Many state's laws have regulated equine farms requiring farm managers to incorporate BMPs. BMP utilization on horse farms needs to be quantified before regulations are adopted. The objectives of this survey are to quantify and assess the use of the equine industry's BMPs in pasture management, erosion control and examine any potential environmental impacts. A 37 question on-line survey (Survey Writer LLC, Chicago, IL) was designed. A list of 1817 email addresses was developed, consisting of horse farm managers from Pennsylvania. The surveys resulted in a 20% response rate. Data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL). Most operations were used for recreational purposes (65.7%) and 34.3% for business. Respondents housed  $8.1 \pm 1.9$  horses on  $21.3 \pm 1.8$  ha (52.7ac) of pasture (businesses reported a mean of 13.4 head / year). An average of 1.5 ha (3.8 ac) were used for heavy use areas. In this study horse farms reported that during winter months 28% of horses were on pastures 24 hours/day. During the growing season, in the spring months 38.6% of horses were turned out on pasture 24 hours/day; in the summer 45%; and in the fall 43%. During winter (32 %) and spring (25) months horse farm managers used limited turn out periods of 6 but no more than 12 hours/day. This grazing strategy is ideal for horse boarding stables or small properties to limit grazing. Half (49.8%) indicated they have never performed soil fertility tests on their pastures, with 25.4% testing soil every 1-3yr. Farms reported applying seed to pastures when needed (27.8%) and 24.9% never having applied seed to their pastures. Most farms (96.2%) mowed pasture on average 4 times per year to control weeds. Most (36.5%) farms never apply lime to pastures, 17.3% applied lime according to soil test results. Approximately, 13% reported their operation has an Agricultural Erosion and Sedimentation Plan or current Conservation Plan dealing with soil erosion and animal heavy use areas. Only 22.7% reported having a Manure Management, Pasture Grazing or Nutrient Management Plan for their operation. More research and education is needed to assess the effect of horse farm management on Mid-Atlantic water quality.

**Keywords:** equine, environment, BMPs, pasture, management

\*Presenter

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**Development and Implementation of an Equine Environmental Stewardship Program**

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**Abstract:** The project team reached 762 horse owners with the Equine Environmental Stewardship (EES) Course workshops, by hosting 29 Equine Environmental Stewardship Workshops, 2-4 day short courses offered in Pennsylvania and New York. Over 3,200 additional farm/horse owners have attended individual workshops dealing with environmental stewardship and farm management issues through Horse Expos, clinics and Pa Ag Progress Days.

Overall, 80 percent (nearly 600) of all workshop participants reported adopting at least two BMPs strategies to improve conditions on their farm. Workshop participants reported that they planned to adopt the following BMPs strategies:

- 74% planned to add additional paddocks, stress lots to reduce grazing pressure.
- 72% planned to generate a forage, weed and toxic plant inventory for their farm.
- 72% planned to renovate the pastures to introduce new varieties and thicken the stand.
- 86% planned to apply nutrients based on soil test results.
- 66 % planned to develop a proper manure storage facility.
- 80% already contact or planned to contact Cooperative Extension for assistance.
- 100% worked on their farm's Manure Management Plan.

As a result of completing the EES short course 90% of participants indicated that they had a large increase in knowledge about forage biology and growth, how to renovate pastures, how to identify forage species, how to properly store and utilize manure, how nutrients affect plant growth, how to apply nutrients based on a soil test report, the importance of identifying weeds in pastures, and who to contact for assistance with pasture and nutrient management planning.

Development of the “Equine Pasture Evaluation Disk” (EPED) proved to be an efficient, accurate, user-friendly method to evaluate canopy cover and document plant species in pastures; 366 adults and 86 youth have used the EPED to evaluate their pastures, with 91% stating that recording data made them more aware of pasture conditions. The EPED has made them more aware of overgrazing and developed an interest in weed identification and control. In addition the EPED and score sheet has been used by 4-H youth groups, at NRCS pasture field days, and SPCA groups. Forty cooperating horse farms (ranging from 5 to 170 acres) were visited to evaluate the operation's environmental best management practices (BMPs) and provided site-specific recommendations. From the 40 farms, 14 equine farms were used as demonstration research sites; and were assisted with increasing pasture canopy cover. However, what was found on many of the horse farms, before renovation, was that pasture canopy cover near 80%, which is acceptable to reduce erosion. However, only 50% of the canopy cover contained desirable forage grasses or legumes. The remaining 30% consisted of summer annuals and perennial weeds. On one of the farms, after reseeding the pasture, conditions improved with

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vegetated cover increased from 80% to 100% with 98% of the cover consisting of perennial plants that can provide erosion protection in winter and early spring. The concentration of forage that supplies nutrition for the horses increased from 50% to 94%. After farm (N=40) visits, 67% of farm managers incorporated the suggested practices into their operations. The remaining 33% reported that they wanted to utilize the suggested practices, but required financial assistance or more technical information.

**Environmentally Friendly Farm Program Recognizes Pennsylvania Farms that Adopt Sound Management Practices Protecting Water Quality and the Environment**

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**Abstract:** The Environmentally Friendly Farm program was developed by **Penn State Equine Extension** and is designed to recognize farms that adopt environmentally sound management practices that protect water quality and the environment. The program is supported by the **USDA Natural Resource Conservation Service (NRCS) - Conservation Innovation Grant**. Strategies are employed on Environmentally Friendly Farms to maintain productive pastures, reduce soil erosion, limit nutrient runoff from animal facilities and barnyards, safely store manure, recycle nutrients, and control animal access to surface waters. Excess sediment and nutrient runoff from manure poses health threats not only to the environment, but also to animals and people. Farm managers who practice environmental stewardship maintain healthy environments for their animals, their families, and their community. The Environmentally Friendly Farm Program is designed to recognize equine and livestock operations that practice environmental stewardship. All commercial and non-commercial farms, regardless of size, are eligible to apply for the program. There is no cost to apply for the program or for the individual assistance that you will receive. Environmentally Friendly Farm recipients will receive an Environmentally Friendly Farm sign and other marketing materials free of charge. Farm managers that apply for the program will benefit by engaging in an ongoing partnership with representatives of Penn State Extension and other agencies that provide on-farm education and individual assistance. The farm will be recognized by the public, conservation and agricultural agencies, and other farm managers as an operation that is committed to clean water and a healthy environment. Each farm manager will receive an Environmentally Friendly Farm sign that can be displayed on the farmstead. Farms that qualify will also be given permission to use the Environmentally Friendly Farm artwork on their website, brochure, and other marketing materials. Approved farms will be listed on the Penn State Equine Extension website. This recognition will reflect the commitment of the farm manager to environmental stewardship and can serve as a marketing tool for the farm.

A copy of the application can be requested from Penn State Equine Extension by visiting us on-line at **[www.extension.psu.edu/equine](http://www.extension.psu.edu/equine)**. Complete the Environmentally Friendly Farm application that requests background information about the farm operation. Next, complete the Environmentally Friendly Farm Self-Assessment Checklist. Each statement is checked “yes” if the practice is in place on the farm, “no” if the practice is not in place, or “non-applicable” if the statement does not pertain to the farm operation. The checklist consists of a series of statements that identify potential on-farm practices in the following areas: Environmentally Sensitive Areas, Pastures, Animal Concentration Areas, Manure Storage Areas, and Mechanical Manure Application. Once the paperwork has been received, a farm site visit will be scheduled. Personnel from Penn State Extension, the County Conservation District, or

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the Natural Resource Conservation Service (NRCS) will visit farms to verify that statements made in the application and checklists are accurate. At the same time, additional information and assistance will be provided to help improve farm management and develop any necessary plans for the farm. When the agency representative verifies that the farm assessment is accurate and that the farm has adopted best management practices that are necessary to protect the environment, applicants receive an acceptance letter inviting them to be a member of the Environmentally Friendly Farm Program. When the acceptance letter is returned, they receive the sign and copy of the official Environmentally Friendly Farm artwork. Farm names will then be added to the list of Environmentally Friendly Farms on the Penn State Equine Extension website and farms will be recognized in the media.

**Factors Affecting Forage Growth on Pastures**

**Freeze Tolerance of Perennial Ryegrass**

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**Abstract:** Perennial ryegrass is the most widely grown cool season grass in the world. Seed producers are developing more productive and more persistent varieties for North America. Different varieties exhibit a wide range of characteristics such as maturity, winter-hardiness, disease resistance, digestibility, dry matter production and persistence. We grew thirteen varieties of perennial ryegrass in a growth chamber, then subjected them to freezing to either 14F, 5F, or -4F (-10C, -15C, or -20C). We used a specially-modified digital camera to take photographs of each variety before and after freezing. These images show the amount of live (green photosynthetic) plant material, rather than the usual visual image. Images from 8 days before the freeze treatment were compared with those from 8 days after to determine the percent change in live cover. The varieties that stand out as being the most freeze susceptible are Baraudi (6), Barmotta (4), Barutti (7), and Kilrea (5). Freeze tolerance did not correspond well to the ratings assigned by the seed companies. The best performer, Barsprinter, was rated a 7 (very tolerant), but so was one of the worst performers (Barutti). Some varieties showed regrowth at longer intervals, however.

\*Presenter

**Benefits of Tillage Radish and Keyline Plowing for Pasture Management**

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**Abstract:** Soil compaction can lower pasture quality and production in particular where stocking rates

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are high. We investigated keyline plowing and biodrilling with tillage radish that were reported to improve soil quality and compaction. The results of the study were surprising in that we did not find some of the expected outcomes. For example, we not find any evidence of increased organic matter that was said to occur by keyline plowing and the overall bulk densities and penetration resistance were not different between the control and treatment paddocks. However, there were other benefits. Soil moisture was reduced in treatment pastures. This may be a benefit to grazing management because drier soils may make pastures available for longer periods of time. In addition, earthworm densities were greater in tillage forage and keyline pastures. Castings were found close to the radish roots. Interestingly, the bulk density of soils surrounding radish roots was less than in soils further from the root. Earthworms may thus further increase infiltration capacity around the radish root channels.

**Residual Forage Mass and Pasture Growth**

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**Abstract:** A goal in pasture management is to optimize animal performance. This may be done best by keeping pasture in the ascending linear phase of growth. If plant growth is controlled by leaf area, theoretically forage mass (FM) may take the form of a sigmoidal curve over time (X) described by a third order regression ( $FM=a + b X + c X^2 - d X^3$ ). This divides into three sections: early exponential, mid linear, and late plateau phases. Managers can document pasture growth by inventorying forage height (FH) and FM in pastures on a weekly basis using calibrated pasture sticks or plate meters. Then use the inventory data to estimate management needs in the future. To demonstrate this management FH was measured on eight rotationally grazed cool-season pastures using a falling plate meter over three years (total of 24 growth periods). Forage height was measured at 30 points at random weekly. We calculated FM using a calibration developed on these pastures. Only the second growth period each year was used since first growth was controlled by suboptimal temperatures and later growth was controlled by dry weather. The growth events used were between May 6 and June 20. Growth curve-form was evaluated using linear regression. Starting with a third order model non-significant variables were deleted until all remaining variables were significant (P=0.05). The data was also evaluated using the non-linear Gompertz growth model. Conventional regression analysis found that of the 24 growth periods 8% had exponential, 50% had linear and 42% had plateau growth curve-forms. There was no effect of FM at the start or end of the growth period on growth curve-form. Pasture fertility status did affect frequency of curve-form; high fertility levels tended more to linear growth. The Gompertz growth model was not useful for evaluating rotationally stocked pastures. The Gompertz model always calculates a slow growth phase. This becomes a systematic error when no slow growth phase occurs. Linear regressions can be performed using spread sheet software which requires little training of those interested in quantitative management. By conducting weekly inventories of FH and FM producers are able to monitor forage availability and forage growth rate. This allows them to manage forage supplies over the year.

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**Inventorizing and Monitoring Pastures**

**Pastures from Space: What can we learn from satellite images?**

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**Abstract:** Satellites such as the Landsat platform record both visible light and near infrared radiation. These can be combined to produce estimates of standing plant biomass. Satellite estimates of plant production have been widely used in rangelands and forests where large areas are studied. The square Landsat pixel is 30 m (98 ft) on a side, so a typical pasture in the Northeast may only contain a few pixels. The small size and frequent grazing, along with the high likelihood of clouds during the growing season, make it difficult to use Landsat to monitor pastures. Improved methods to adjust for weather conditions and small pasture areas make it possible to compare pastures within a farm for a single date, and to compare pastures on successive sampling dates. We expect to be able to improve the accuracy even more, making satellite data an effective tool for both farm management and regional planning.

**How well can we predict forage species occurrence and abundance?**

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**Abstract:** As part of a larger effort focused on forage species production and management, we have been developing a statistical modeling approach to predict the probability of species occurrence and the abundance for Orchardgrass over the Northeast region of the United States using two selected statistical methods: a Generalized Linear Model (GLM) and a Generalized Additive Model (GAM). The predicted maps describe the suitability of the species for the region and the role of environmental factors on species growth. Field observations and ecologically meaningful gridded environmental variables (climate, topography and soils) were used to create the models. The predictors involved in the models were statistically significant with the r-squared of the model accuracy being between 0.3 and 0.4. Our results indicate that the predicted spatial patterns of species distribution appear to be ecologically realistic for most areas and are consistent among the different statistical methods. From an ecological point of view, the distributions for species abundance were more accurately predicted than that of species occurrence.

We estimated the predictive performance based on cross-validation using the quantitative criteria for comparing the predictive ability of the statistical models. Our dataset was divided into “training” for calibration with 70% of data and “testing” for validation with the remaining 30% of data, because we currently do not have another independent dataset with suitable forage species available.

These optimal models could be applied to explore scenarios based on historical, current and future land use change and climate change across the landscape for the region, addressing potential species re-

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sponse to changing environment. The approach we have followed in this project could be used to establish species distribution models that may be useful for other herbaceous species prediction, given the existing data of about 100 forage species available in our database.

**Investigating Livestock Agriculture Impacts on the Environment & the Economy**

**An Environmental Assessment of Grass-finishing Beef Operations in Pennsylvania**

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Concern for the environmental sustainability of traditional beef production has increased consumer interest in alternatively produced beef products perceived to be more environmentally friendly. This includes those marketed under “grass-fed beef” labels. However, little information exists on the environmental impact of either conventional or grassed beef production. The objective of this work was to quantify the environmental footprints (carbon, reactive nitrogen, water, and energy) of a representative grassed beef operation in Pennsylvania. A partial life cycle assessment was conducted using the Integrated Farm System Model (IFSM) to estimate greenhouse gas emissions, reactive nitrogen loss, and water and energy use. The estimates were determined through a 25-year simulation of a grassed beef operation in Lancaster County, Pennsylvania that included cow-calf to finish phases. An Angus herd of 80 cows, 15 replacement cattle, 52 stockers, and 51 finishers was rotationally grazed on 250 acres of managed perennial grassland. Calf weaning weight, finish weight, and average mature cow weight were 524 lb, 1200 lb, and 1300 lb, respectively. Feeder calves to be marketed under a regulated “Grassfed Beef” label were managed according to published grassed beef marketing regulations, in which cattle may consume only forage for the duration of their lifetime, with the exception of milk prior to weaning. Supplementation was provided to cattle, per published guidelines on supplementation restrictions, only during times of inclement weather or when forage quality was low. Average annual carbon, reactive nitrogen, and energy footprints were  $14.4 \pm 0.6$  lb CO<sub>2</sub>e/lb BW,  $0.12 \pm 0.02$  lb reactive N/lb BW, and  $10.4 \pm 1.0$  MBtu/lb BW sold. Average annual water use was  $1700 \pm 169$  gallon H<sub>2</sub>O/lb BW sold. Excluding rainfall, this average annual water use was small at  $31 \pm 3$  gallon H<sub>2</sub>O/lb BW. Through simulation of traditional beef production in the Midwest, Rotz et al. (2013) found an average annual carbon footprint of  $10.9 \pm 0.6$  lb of CO<sub>2</sub>e/lb BW, a reactive nitrogen footprint of  $0.092 \pm 0.02$  lb N/lb BW, and an energy footprint of  $11.4 \pm 1.9$  MBtu/lb BW. Due to greater use of irrigation, the annual water footprint was  $2550 \pm 670$  gallon/lb BW sold, and the water footprint excluding precipitation was  $330 \pm 110$  gallon/lb BW. The results of this simulation study suggest that management practices associated with grassed beef production reduce water and energy use but may increase greenhouse gas emissions and reactive nitrogen loss relative to traditional beef production. Future research efforts will center on collection of data from grass feeding operations in the northeast to improve our representation of operations in the region. Generating data related to environmental impacts of grassed beef will both improve producers’ access to information to aid in decision making, and improve our ability to make inferences and comparisons about the environmental impacts of differing beef production systems.

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Rotz, C.A., B.J. Isenberg, K.R. Stackhouse-Lawson, and J. Pollak. 2013. A simulation-based approach for evaluating and comparing the environmental footprints of beef production systems. *J. Animal Sci.* 91:5427-5437.

**Assessing the land resource capacity for pasture-based dairy farming in the Northeast**

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**Abstract:** Research has demonstrated that pasture-based dairy farming can offer many potential benefits for farmer incomes, animal welfare, and environmental quality. However, a common criticism of pasture-based dairies is that relative to confinement production, they produce less milk per acre of farmland, so they may not be able to provide dairy products for a large human population. Most comparisons of the land efficiency of pasture-based and confinement dairies have been made at the farm or field scale. Therefore, these estimates do not take into account constraints that may exist at a regional scale in terms of land resources available for producing the range of annual and perennial crops that comprise dairy rations. In this project, we are assessing the land resource capacity of the 13-state Northeast region to produce milk using confinement and pasture-based animal rations. Most counties in the Northeast have more land suitable for pasture and hay production than for annual crop production. Our preliminary analysis indicates that when the proportions of perennial and arable land resources in the Northeast are taken into account, pasture-based systems may be substantially more land efficient than previously assumed.

**Nutritional Quality of Pasture-Based Dairy Milk**

**Case Study: Variation in fatty acid profiles in milk from adjacent organic and conventional dairy farms over a 3-year period**

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**Abstract:** Measuring the seasonal variability of fatty acids (FAs) in milk improves our understanding of the nutritional and health values of milk. In collaboration with the Rodale Institute, Kutztown, PA, a 3-year study evaluated the seasonal variation of FA profiles of milk obtained from two farms adjacent to the Rodale experimental farm: one farm transitioned to organic in the first year (cows consumed a minimum 30% dietary energy from pasture during the grazing season) while the other was a confined conventional farm (no access to pasture). This study provided a unique opportunity to compare milk from farms of similar soil types, climate, and weather.

Over the 3-year period (including 3 grazing seasons), weekly milk samples were collected and FA profiles generated focusing on the different forms of the FAs containing 18 carbons and multiple double bonds known as polyunsaturated FAs (PUFA), which have been shown to impact human health. Fatty acid analysis showed considerable variation within and between the herds from week to week and

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year to year. Although many factors influence the FA levels, certain trends were seen. As expected, the grass-fed animals had more variation in the PUFA levels than the conventional herd, which consumed a more uniform diet. In the grass-fed herd, the overall averages for PUFA in the 2nd and 3rd grazing seasons were consistent, with conjugated linoleic acid (CLA) and C18:3 levels 38% and 29% higher than in the conventional herd, respectively. During the first grazing season, while the herd was in transition, the differences in PUFA between the two herds were lower. The C18:2 averages were consistently lower in milk from grass-fed than the confined herd. Higher CLA levels and a low C18:2 to C:18:3 ratio are considered beneficial to human health.

Findings from our research will help establish the seasonal variation in FA profiles from grass-fed animals and develop guidance to help dairy farmers produce milk with the highest possible nutritional and health values.

**Correlating Milk Nutrition and Forage Quality interactions on Organic Dairy Farms**

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**Abstract:** In the face of increasing feed costs and mounting market pressure for higher nutritional content in food, a 2-year observational study to record and explore the interactions of feed quality, ration balance, and milk nutrition on working organic dairies throughout the United States was developed and implemented beginning in 2011. In cooperation with 9 participating organic dairy farms, this study sought to combine sample collections and farmer surveys to collect detailed feeding and milk nutrition data on a monthly basis through two full seasons of production. The study tracked the interplay of seasonal variability across several different feeding regimes with a particular focus on Omega fatty acid ratios in the resulting milk. While continuing analytical work is currently underway, initial analysis indicates a correlation between average grain feeding on a per head/per day basis and the ratio of Omega 6:Omega 3 fatty acids recorded in the resulting milk. Amount of dry matter from pasture also appears to be correlated to increased levels of Omega 3 fatty acid, and Conjugated linoleic acid (CLA) recorded in analyzed milk samples.

\*Presenter; for the above poster, Peter Miller, East Division Pool Manager, Organic Valley/CROPP Cooperative, is the presenter.

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**Ruminant Nutrition on Pastures**

**Feeding Strategy and Pasture Quality Relative to Nutrient Requirements of Organic Dairy Cows**

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**Abstract:** According to the recently revised National Organic Program “Pasture Rule”, certified organic dairy cows are required to obtain at least 30% of diet dry matter (DM) intake from pasture during the grazing season. Therefore, understanding the nutritive quality of pasture as a feed relative to requirements of dairy cows has become increasingly important for organic farmers.

Pasture samples (n = 216) were collected during the grazing season from 14 certified organic dairy farms in 2012 (in PA, ME, NY, NH, VT) and on 12 farms in 2013 (in PA, ME, NY). Nutritive composition of the pasture was measured by an independent commercial laboratory (Dairy One). A Mixed model (SAS Inst., 1998) was used to test effect of year of sampling, month of sampling, and farm on crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), net energy for lactation (NEL), calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), and sulfur (S). Least square means are presented and differences significant at P is less than 0.05. Frequency analysis was used to determine the proportions of pasture samples that met minimum energy, CP and macro-mineral requirements, according to the Dairy NRC (Nutrient Requirements of Dairy Cows, 2001), for a 1496 lb Holstein, producing 55 lbs milk/day, with 3.5% milk fat and 3.0% milk protein. Finally, the Large Ruminant Nutrition System (LRNS, Version 1.0.24) was used to model feeding strategies that accompany grazing on 3 of the participating farms, early in the grazing season. Farm 1 practiced component feeding of grain, silage, and hay, Farm 2 supplemented with a homegrown grain mix, and Farm 3 fed an all-forage diet (pasture) with minimal dry hay. During farm visits, current management and production information was collected for input to LRNS. Model inputs were specific to environmental conditions, nutrient concentrations of feeds, and cow type and level of production on each farm.

Year of sampling affected (P is less than 0.05) pasture CP, ADF, NEL, and Mg, such that pasture quality was slightly better in 2012 compared to 2013, as characterized by greater levels of CP (19.9 vs. 18.1%) and NEL (0.63 vs. 0.60 Mcal/lb) and lower ADF (30.7 vs. 33.0%). This may have been due to regional areas of drought at many of the sampling areas in 2012, resulting in drought stressed forages with greater concentrations of nutritive components. Year had no effect on pasture NDF, Ca, P, K, and S. Month of sampling affected (P is less than 0.05) all pasture quality parameters except ADF (P = 0.19), revealing the expected patterns in seasonal variation of forage quality within each year. Forage quality decreased during warm, dry months when forage growth slowed and began to increase again in late summer/early fall. Farm affected (P is less than 0.05) forage quality parameters and macro-mineral

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concentrations except S. If pasture was the only diet component (as in Farm 3), energy was the most limiting nutrient, with 39% of pasture samples failing to meet the minimum NRC energy requirement for a Holstein cow producing 55 lbs of milk/day. Only 7% of pasture samples did not meet the minimum CP requirements, at the same level of production. Calcium, P and S did not meet minimum NRC dietary requirements in 33, 17, and 10% of pasture samples, respectively. Average concentrations of Mg and K were in excess of 161 and 1,117% of dietary requirements; however these values are typical for pastures in this region. It is important to note that all farms in this study did provide mineral supplementation of some form.

Milk production was 45.6, 37.0 and 29.9 lbs/day for Farms 1, 2 and 3, respectively. Percent of daily DM consumed from pasture was related to feeding strategy, even though total DM consumption of pasture was very similar between farms, ranging from 27.2 to 28.5 lbs/day. Cows on Farms 1, 2, and 3 obtained 79, 85 and 91% of daily DM intake from pasture. Metabolizable protein provided by the total diet (pasture and supplementation) exceeded the requirements at the specified level of production and environmental conditions for all 3 farms evaluated. However, nitrogen available to rumen microbes was found to be slightly deficient for Farm 2 (balance of -0.04 lbs/day), which was supplementing pasture with 5 lbs DM grain, possibly due to the low soluble protein in the diet (28.8% of CP). No changes were predicted in body condition score for cows on the 3 farms, based on the forage quality, supplementation strategy, and environmental conditions evaluated at that particular point in time. Energy concentrations of the total diets were comparable for Farms 1, 2 and 3 (0.69, 0.70 and 0.71 Mcal/day NEL DM, respectively). Crude protein concentrations (as a % of DM) of the diets were 15.2, 14.9, and 18.5% for Farms 1, 2, and 3, respectively.

Overall, the forage quality of pastures evaluated in this region was high. As expected, energy was found to be the first limiting nutrient for milk production for a 1496 lb Holstein producing 55 lbs milk/day. Crude protein generally met or exceeded minimum NRC animal requirements at the same level of production. Mineral supplementation of Ca, P, and S should be considered for grazing cows in this region, whereas forage Mg and particularly K are often in excess. Regardless of supplementation strategy, cows were observed to consume a comparable amount of pasture daily (approximately 28 lbs DM). The farm providing component feeding of silage, hay, and grain had the greatest milk yield and the all-forage farm had the lowest milk yield, out of the 3 farms. However, it is important to note that many organic dairy producers take advantage of grazing systems and manage for optimal milk production relative to available forage compared to maximum milk production, and the economics for feed cost and milk pay price were not considered in this discussion. Varying feeding strategies allow producers to use feed resources such as pasture and homegrown forages and grains to meet individual goals of milk production for each farm.

**Dairies Utilizing High Stock Density Grazing in the Northeast**

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**Abstract:** High density stock grazing (i.e. mob grazing) is a practice that is being evaluated and used by experienced and new grazing dairy farmers. We have since learned that most dairy farmers call mob grazing, "high density stock grazing" (HDSG). The cattle are grazing pastures higher and leaving higher grass residuals, while the farmers are still striving for high quality forage.

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High density stock grazing is a very new practice in dairy production and the study captures some of the ground-level practices of the innovative farm families. There is very little research-based information for farmers, extension personnel and conservation professionals to use.

Each farm has resource challenges and opportunities that impact the ability to use this type of grazing. Our goal was to collect pasture data and interview the farmers to understand their management goals and practices. We developed a sampling protocol and questionnaire. The questionnaire was used to capture a variety of responses from 5 farm families. This information included indicators of profitability, sustainability and community. Case studies were developed in winter 2013 and are designed to create a “snapshot” of the farms. Outreach was conducted in the growing season of 2013.

Pasture data was taken in advance of cattle grazing a paddock. Data includes grass height, BRIX measurement, forage analysis, botanical composition, soil testing and soil bulk density. Measurements were taken in 2012, with additional measurements in the spring of 2013.

Outcomes for behavior change will be monitored by evaluating participants at the proposed field day and other items. The project assisted 4 partners to work in a collaborative fashion and benefited their own understanding of this practice by innovators.

\*Presenter