UMass Extension
Crops, Dairy, Livestock & Equine Newsletter

SUMMER 2016

VOL. 18:4

Inside this issue:

Editor,

Masoud Hashemi

Upcoming Events:

Maintaining and enhancing protocols to treat sick animals and analyzing production practices – case studies
Thursday , September 8th 10am-1pm
URI, East Farm, Building 75, 2163 Kingston Rd., Kingston, RI
www.meatsystems.uconn.edu

Stockbridge Homecoming 2016
Paige Laboratory Engineering Quad
Saturday, October 1st
9:30am to 2:30pm
https://stockbridge.cns.umass.edu/stockbridge-homecoming-2016

American Hanoverian Society Inspection @ UMass Hadley Farm
Monday, October 10th
9am - 3pm
Spectators welcome!
https://hanoverian.org/event/university-massachusetts-inspection/

UMass Perspective Student Open House
Sunday, October 16th
https://www.umass.edu/admissions/fall-open-house

UMASS Equestrian Team Home Show @ UMass Hadley Farm
Saturday, October 22nd
9am - 3pm
Spectators welcome!

Announcements:

UMass Hadley Farm Revitalizes the Bay State Morgans

UMass Hadley farm announces its newest arrival, "Bay State Legacy", a Morgan filly named in memory of alumni and long-time supporter Susan B. Roberts, who passed away unexpectedly last year.

The Bay State Morgan line was established in 1951 when the U.S. government disbanded its cavalry horses. The University of Massachusetts acquired 11 mares and 2 stallions, including stallion "US Panez", from the U.S. Calvary remount station in Middlebury, VT.

Bay State Legacy and her mother Bay State Distinction can trace their bloodlines all the way back to those original cavalry horses including US Panez and broodmare Optic, carrying on the government tradition. Using donations from the Susan B. Roberts memorial fund, the university bred Distinction to USEF Horse of the Year "GKB Coal Magic" owned by Dr. Lucy Tidd of Maryland. "This is a phenomenal cross" says Dr. Cassandra Uricchio, Director of the UMass Equine program, "and will help revitalize the university's Morgan breeding program."

For more information about the UMass Equine program or Bay State Morgan horses, please contact Dr. Cassandra Uricchio at curicchio@umass.edu or 413-345-0183.

UMass Equine Management Summer Pre-College Program 2016

Twenty-two high school students from around the country attended the Equine Management Summer Pre-College Program at the UMass Hadley Farm. Students participated in this intensive program to explore what it takes to succeed in the horse industry, participating in hands-on practicums and workshops with UMass faculty, visiting equine professionals, and the Bay State horse herd. The students gained college credit while also experiencing campus life and exploring equine careers.

http://www.umass.edu/summer/precollege.html

Managing Phosphorus in Organic Residuals Applied to Soils:

Composts, Biosolids, Manures, and Other Organic Residual Sources

A symposium presented by the University of Massachusetts Extension Agriculture and Landscape Program

Topics Include:

Policy, management, and regulation of P in New England

Analysis and Interpretation of P in soils and organic residuals

Mitigation strategies for high P soils and use of organic residuals

Round table discussions on best practices for organic residuals use for Vegetable, Dairy, Turf and Landscape industries.

Join industry experts, educators, and scientists from UMass, Cornell, Penn State, and UMaine

Wednesday November 2, 2016
8:15 Registration
8:45am-4:00pm
Holiday Inn
265 Lakeside Ave.
Marlborough, MA

$85 Registration, Lunch Included
Sponsorship Opportunities Available
Please direct any questions to UMass Vegetable Specialist Katie Campbell Nelson kcampbel@umass.edu , UMass Turf Specialist Mary Owen mowen@umass.edu or Event Coordinator Kelly Kraemer kkraemer@umass.edu

UMass Extension

2016 Massachusetts Outstanding Dairy Farm

The University of Massachusetts Crops, Dairy, Livestock, and Equine team would like to congratulate Barstow's Longview Farm for receiving the 2016 Outstanding Dairy Farm Award

Barstow’s Longview Farm has been a working dairy farm since the early 1800s situated in a small picturesque hamlet called “Hockanum” which has been designated as a National Historic District on Route 47 in Hadley. They are member-owners of Cabot Creamery, a $1,100^{+}$ farm family dairy cooperative with members in New England and upstate NY. Barstow’s Longview Farm is run by 6^{th} generation brothers, Steven and David, along with Steve II, 7^{th} generation. The farm expanded in 2008 and opened a year round farm store and bakery that serves breakfast and lunch, as well as local products including dairy, their own beef, and specialty food products from area food producers. The Barstow’s have a deep commitment to the land and the environment and continue to be stewards to the land.
Their most recent project includes an anaerobic methane digester, installed in 2013. They are turning cow manure and feedstock into electricity. In partnership with, Vanguard Renewables, the project aims to manage organic byproducts from Massachusetts food companies, produce fertilizer products, generate renewable energy, and reduce greenhouse gas emissions while supporting small scale farming. Manure and feedstock is mixed and digested to produce annually over 18,000 MWh of electrical energy, 70,000 MMBtu’s of thermal energy, and 58,000 tons of liquid fertilizer. One Barstow cow is producing enough electricity to power one average Massachusetts home and removes the equivalent greenhouse gases of three cars per cow from the atmosphere.

The Barstows invested in four milking robots to milk their 225 milking cows. The four ‘Lely Astronaut’ milking machines allow our cows to choose when and how often they are milked. The robots closely monitor cow health, while allowing more farmer freedom to take care of the many other demands on the farm. We are already seeing the benefits including an increase in milk production.

We continue to look toward the future with the sustainability and future of our dairy farm and the planet in mind.

Annual Dairy Twilight Barn Meeting

Kelly Kraemer

On July 20, 2016 Jordan's Dairy Farm in Rutland, Massachusetts hosted the annual Central Massachusetts Dairy Producers Association Twilight Barn Meeting. This event was well attended with over 80 farmers and regulators coming from throughout the area. The evening began with a warm welcome by Dr. Masoud Hashemi, Associate Professor at UMass and Crops Dairy Livestock Equine Team Leader. Following Dr. Hashemi's welcome, State Representative Kim Ferguson and State Senator Anne Gobi spoke on the new comprehensive economic development legislation that was recently passed and how it will stimulate the Commonwealth's economy and have a positive effect on agricultural communities.

The attendees were then led through Jordan's farm on guided tours. John Hanselman, Executive Chairman of Vanguard Renewables was on hand to answer any questions about the anaerobic digester on site. The Jordan's farm is the first to install a digester which uses sorted solid organics to produce power. This digester creates 300 KW per hour, powering the entire farm and an additional 300 homes.

The major topic of discussion was the innovative no till cover cropping system. Kate Parsons from the NRCS headed a farmer led panel discussion on the pros and cons of implementing a no till system. Farmers from throughout the area including Fred Hess, Jim Koebke, Jay Galusha, and Mark Anderson participated. An NRCS led demonstration of a rainfall simulator gave a great visual of the benefits of no-till farming and cover crops and how they benefit soil health and improve the water cycle on cropland and pasture across the state. No-till cropland and rangeland managed with cover cropping can increase infiltration and reduce runoff and sedimentation. This included discussion on infiltration, aggregate stability, soil structure, and how these relate to runoff, erosion, and water quantity.

The evening concluded with food catered by Whittier Dairy Farm and updates on state agencies including MDAR, FSA, and RMA.

UMass Crops Dairy Livestock Equine Team would like to extend a special thank you to the Jordan family for their hard work and hosting our event this year.

For more information please contact, CDLE Team leader, Dr. Masoud Hashemi at masoud@umass.edu.

Making the transition to no-till corn/cover crop system

Masoud Hashemi (UMass), Richard Kersbergen (UMaine), Kate Parson (NRCS-Amherst) and Samantha Glaze-Corcoran (UMass, PhD Candidate)

In New England, farmers generally rely on tillage to create a warm, dry, and weed-free seedbed. However, tillage makes the soil susceptible to erosion, and contributes to soil compaction, especially when the soil is wet and not well dried. Intensive tillage, lack of surface cover, and insufficient crop residue has played a significant role in soil degradation. In recent years, research by Extension and universities, as well as soil health campaigns by NRCS, have raised awareness and expanded farmer demand for more information pertaining to cover cropping and no-till systems.

Benefits of no-till with cover crop systems include:

- Minimized soil degradation, including erosion, crusting, and compaction.
- Water conservation from reduced soil evaporation due to residue on the soil surface, elimination of tillage practices that dry the soil, and more water stored in the soil due to increased organic matter levels, culminating in improved crop tolerance to drought.
- Increased soil organic matter as well as improved soil structure that will improve water infiltration.
- Reduced cost of operation – reports average $50 per acre savings in fuel and labor costs.
- Earlier plantings of corn following winter grain cover crop, which increases the likelihood of harvesting first cut hay, haylage, or baleage at peak nutritional quality.
- Improved opportunity to graze or harvest cover crops as emergency feed without significant delays in planting corn.
- Enhanced natural soil fertility due to improvements in soil biology.
- Less rocks to pick and more opportunity for efficient crop rotations.
- Protected soil from high summer temperatures and heavy rains.

Farmers are increasingly adopting no-till management in their cropping systems, and the number of those considering a transition to no-till is fast growing. However, the transition from conventional to no-till may present some challenges. There are several concerns that farmers need addressed before making their final decision:

Q: Is there a crop yield penalty in either the short or long term?

A: UVM Research has shown a slight yield drag when transitioning continuous corn fields to no-till while the soil improves from the cover crop and the reduced soil disturbance. Some dairy farmers in the Northeast however have not seen a reduction in yield. UVM research, along with countless farmer experiences, does not show a yield drag when starting no-till corn into hay fields that are terminated in the previous fall with a herbicide. This technique is also a great way to start a crop rotation in fields that have not traditionally been used for corn silage production.

In fact, with extreme changes in weather conditions, including longer period of no or little rain, it is expected that corn grown in no-till system will perform better than those planted conventionally.

Q: Should changes be made to fertility management?

A: The short answer is yes. The following list includes tips and considerations for fertility management in no-till systems:

Soil pH can be more difficult to manage. The transition to no-till will be best if the soil pH is already in a desirable range.

Nutrients applied to the soil surface, including lime, may become concentrated in the topsoil. Soil testing of the top two inches of soil, as well as the standard six inch depth, may be useful to identify a build-up. If the nutrient concentration test results from the six-inch deep sample are optimum or high, then nutrient accumulation near the soil surface should not be a concern. If the six inch results indicate low or very low nutrient concentrations and/or the two inch depth indicates high concentrations, then injecting phosphorus and potash with the planter or a separate fertilizer injector is recommended.

Manure cannot be incorporated into soil; if injection is not an option, ammonia nitrogen (potentially up to 50% of the total nitrogen in liquid manure) may be lost to the atmosphere. However, many researchers and farmers believe the benefits of no-till and the use of nitrogen conserving cover crops outweigh the potential nitrogen loss.

Cover crops capture nitrogen from manure and residual nitrogen from the previous season, thus helping to reduce nitrogen inputs to subsequently planted corn. Even so, most no-till experts recommend applying 30-50 pounds of N per acre as a starter. This would be especially necessary if rye or other winter grain cover crops were terminated at a more mature stage.

Q: Do no-till systems require changes in corn hybrid selection?

A: No specific corn hybrid has been developed to perform better in no-till system. However, two of the integral parts of no-till corn are weed control and cover crops. Cover crops should be an essential part of no-till corn system. **Figure 1** clearly illustrates that no-till systems with cover crops provide much more benefit than adopting no-till management without including cover crops in the rotation. To facilitate cover crop establishment, shorter-season corn hybrids should be selected as they will mature in time to get an effective cover crop established by mid-September. Earlier maturity hybrids do not necessarily mean lower yields. UMaine, UMass, and UVM corn hybrid trial data has indicated that shorter-season corn does not suffer a significant yield penalty. Proper short-season hybrids can be selected based on their yield and quality performance from annual trials that are published by the above three states.

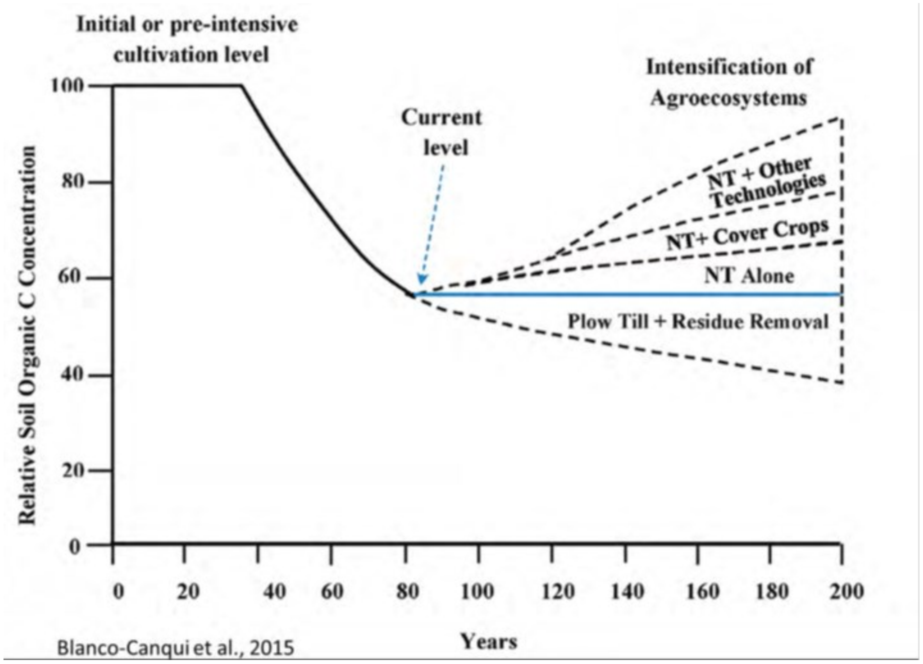

Figure 1: The influence of various farming practices on soil organic carbon

Q) What is it about cover crops that make them so important for no-till to be successful?

A) Cover crop roots break up compaction and create pores that are used by the following corn crop's roots. Soil microbes that feed on carbon exuded from the roots, as well as the roots themselves after cover crop termination, produce sticky substances that bind soil particles together into aggregates. Aggregates are the key to allowing your no-till soil to breathe, infiltrate water and withstand heavy equipment. Some farmers have equated cover crops to "driving on geotextile fabric". The soil microbes are as important as the rumen microbes in a dairy cow.

Q) How different would be weed management compared to conventional corn system?

A) In general, surface-applied pre-plant or pre-emergence herbicides are recommended to control early-emerging weeds, even if glyphosate-tolerant corn hybrids are used. Many no-tillers include the residual herbicide with the cover crop burndown. In general, annual weed pressure is reduced due to the heavy cover crop residue and limited soil disturbance.

Q: Does transitioning to no-till system reduce costs?

A: There are some initial costs to consider when transitioning to a no-till corn system. Some growers have modified their existing planters, while others have purchased new no-till planters. Both can be effective, but the key will still be to get the right seed placement. Some guidelines can be found on some You Tube videos from Vermont.

https://www.youtube.com/watch?v=kTAT9dB1qZM and https://www.youtube.com/watch?v=rhTHvgp5kfg

Some key components are row cleaners, and/or wave coulter in front, proper packing wheels, seed firmer, and closing wheels. Additionally, the double disk openers may need to be replaced more frequently. There are cost savings in reduced plowing and harrowing. Using 2016 Pennsylvania custom rates, producers would save about $35 in acre by simply eliminating plowing and harrowing. In recent studies in Maine and Vermont, producers indicated a cost savings of $50 per acre in fuel and labor.

Adjustments you may want to make for transitioning into no-till:

1) The easiest and most successful entry point into no-till corn production is to start with killing a sod crop in the fall and planting into the killed sod crop in the spring. This technique is also a great way to start a crop rotation in fields that have not traditionally been used for corn silage production.

2) Get your cover crop planted! Experienced no-tillers recommend cutting small grain rates back to 80-100 lbs. per acre, particularly when they can get the cover crop sown early in the fall (Before September 15) and they plan to allow the cover crop to get tall in the spring and do not plan to harvest it. This reduces the volume of material that the planter needs to get through.

3) One concern when planting into a cover crop (killed or green) or into a dead sod is seeing your row markers! Some producers use foam markers to make it easier to see where their next pass will be. Others have purchased GPS monitors.

4) Since the potential exists for a more variable seed placement, you may want to increase your seeding rate by about 10% to ensure a projected population. Keep your corn planter in excellent working condition and adjusted properly and plan to plant slower than you typically do. Make sure to get off the planter and check seed depth, especially when moving to fields with different soil types.

5) By choosing shorter- season corn varieties, you are improving your odds of harvesting your crop when weather conditions are favorable, and you will not cause as much compaction or make as many ruts with trucks, tractors and wagons. For more Northern states, the earlier harvest will also reduce the risk of running into adverse wet weather conditions at harvest. Think about driving patterns for trucks entering the field to reduce the potential for problems in the future.

6) Scout your fields! We have seen the potential for armyworm damage in no-till corn after a winter grain cover crop. Armyworm moths may be attracted to lay their eggs on the cover crop in early spring, and then the larvae will be ready and waiting for the corn! We have also seen the potential for increased slug and snail damage when there is a lot of residual organic matter on the soil surface.

7) Don't rely on a single application of herbicide for weed control. While many times, the killing of the cover crop may provide you with adequate weed control, we always recommend monitoring fields for weed populations. You may want to spray with some pre-emergence products or come back later with some post emergence products. Just be aware that certain weeds are difficult to control post-emergence (ex. crabgrass) while others are best-controlled post emergence (ex. field bindweed).

Some other resources for reduced tillage and cover crops are available at:

http://www.uvm.edu/extension/cropsoil/soil-health-and-nutrient-management
http://www.uvm.edu/extension/cropsoil/wp-content/uploads/UnderCoverGuide.pdf

Current Research on Cover Crops and Soil Health

Sunn Hemp: A New Legume Cover Crop to Massachusetts

Fava bean as a new legume cover crop for sweet corn production

Fatemeh Etemadi, Masoud Hashemi, Frank Mangan, Wesley Autio

Statement of problem

Legume cover crops have great potential for providing substantial amount of nitrogen when their residues are decomposed. However due to low C: N ratio, nitrogen release from legume cover crop residues may not be well synchronized with crops' need. Fava bean (*Vicia faba* L.) is a cool season legume that can be grown as cash crop while it continues growing and serve as late fall cover crop. A split-plot design experiment was conducted to study the quantity and synchrony of nitrogen release by fava bean residues with following sweet corn. Main plots were consisted of conventional (CT) and no-till (NT) tillage systems whereas subplots assigned to five nitrogen rates (0, 25, 50, 75 and 100 kg N ha^{-1}) applied when sweet corn reached 25 cm height. Samples were taken for monitoring sweet corn biomass accumulation. Under CT, fava bean residues decomposed rapidly thus when sweet corn began its active growth; almost 65% of its original nitrogen was available to the growing crop. Under NT, nitrogen release was significantly slower where 50% of original nitrogen was still remained in the cover crop residues (Fig.1). Fava bean contribution to nitrogen need of sweet corn was estimated as much as 50 kg N ha^{-1}. Sweet corn planted into fava bean residues plus application of 50 kg N ha^{-1} yielded as much as sweet corn that received 100 kg N ha^{-1} with no cover crop.

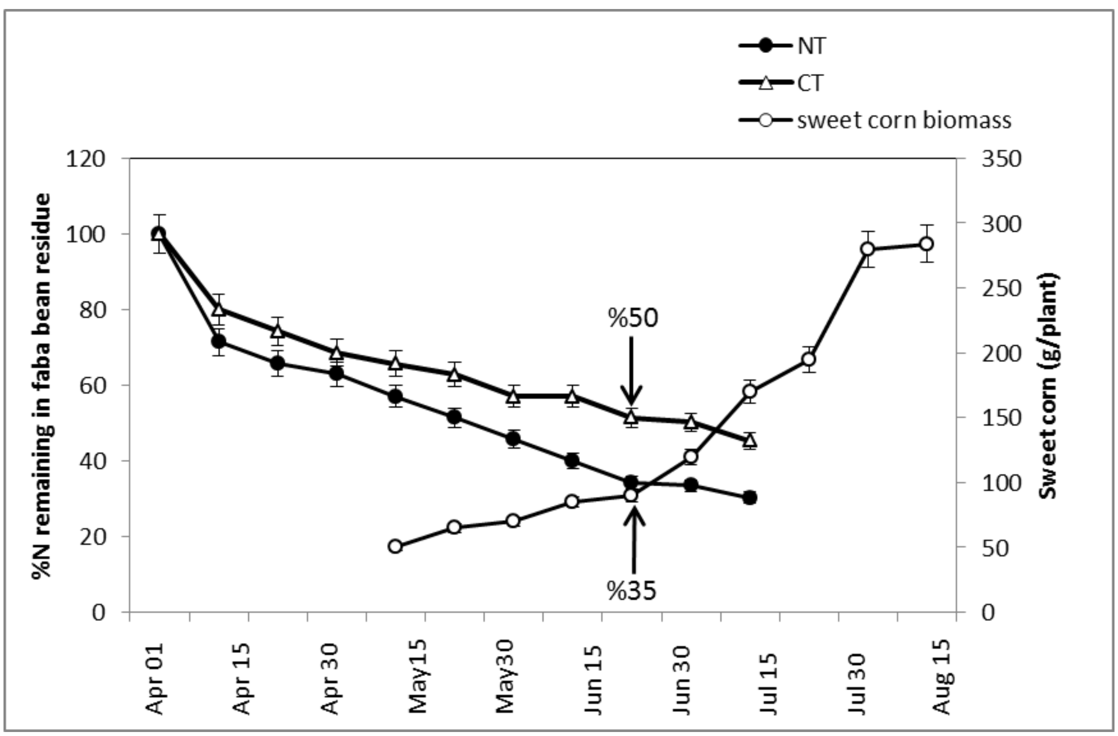

Figure 1. Biomass accumulation in sweet corn and nitrogen release from fava bean residue under NT and CT tillage systems. Means are averaged over two growing seasons and three replications.

Integrating Cover Crop Mixtures with No-Till Sweet Corn Production

Julie Stultz Fine and Masoud Hashemi

Cover crops are known to improve crop production and soil health under the right conditions. In order manifest these benefits the appropriate cover crop species or mixture should be selected to complement the needs of the crop. Fall-planted forage radish (aka tillage radish) efficiently scavenges residual nitrate from the soil after a main season cash crop. The fleshy taproot rapidly depletes soluble soil nitrogen at depths from 60 to 70 inches, exceeding the capability of the more commonly used rye. Large root channels created by the radish provide excellent water infiltration in spring after the radish has winter-killed. The seedbed following forage radish is relatively warm, weed-free and residue-free, therefore optimal for direct seeding in a no-till system.

The major disadvantage of forage radish is that it has a low Carbon to Nitrogen ratio (C/N ratio), and as a result it decomposes very quickly in the early spring. Nitrate released before a growing crop is simply leached out of the soil. If N released by decomposition is not synchronized with the N demand of the corn, that it is money down the drain.

Planting a mixture of cover crop species adjusts the carbon to nitrogen ratio, slows decomposition in spring, and alters the timing of nitrogen release to the subsequent crop. Our goal is to develop a sustainable, no-till production system for early sweet corn in the Northeast that will maximize the benefits of forage radish by using multi-species cover crop mixtures.

In this research, two mixtures of cover crop were selected to compare the effects on weed suppression and synchrony of N availability: **Oat+Forage radish** (50 lbs/acre oats + 3 lbs/acre radish) and **Pea+Oat+Forage radish (**45 lbs/acre peas + 30 lbs/acre oats + 2 lbs/acre radish). **No cover crop** and **100% forage radish** (7 lbs/acre) were planted for controls. All of the species in these cover crop mixes are winter-killed in New England in order to simplify spring residue management.

Results are still being analyzed, however the benefits of all three cover crops are significantly better than no cover crop. In year 1, the forage radish had the highest yield in ears per acre; In year 2, Pea+Oat+Forage radish had the highest yield. However, all three cover crops had significantly higher yield than no cover crop. Oat+Forage radish had the highest sweet corn emergence, the highest C:N ratio (averaging 25:1), and best soil nitrate availability at peak corn demand. All of the cover crops performed well in terms of yield, fall weed suppression, and fall nitrate scavenging. As weather varies from year to year, there may never be a single perfect cover crop. But, by mixing multiple species you may get flexibility as field conditions change.

Interactive effects of biochar and potassium application on soil health and edamame seed yield and quality

Omid Reza Zandvakili, Allen Barker, Masoud Hashemi, Baoshan Xing, Kristen DeAngelis

In recent years biochar has gained increasing attention due to its potential for carbon sequestration and improving soil health. Both benefits can have a high impact on the northeastern USA in mitigation of climate change and enhancing crop productivity. Most studies on biochar have been conducted in controlled (greenhouse) condition and field studies have been focused on relatively short-term impact of biochar. A 3-year field study was conducted in the Research Farm of University of Massachusetts in 2012-2015 to investigate the effect of different rates of biochar application on soil properties. Some results indicated:

1.) Soil pH gradually increased with biochar application. Higher rates of biochar application resulted in higher soil pH.
2.) Soil Ca, Mg and K increased with application of biochar. Higher rates of application resulted in higher rates of Ca, Mg and K.
3.) Soil Fe and Al showed a decreasing trend with application of biochar. Higher rates of biochar application resulted in lower rate of Fe and Al.

Biochar may specifically interact with potassium (K) as well as other cations in soil and therefore influences soil nutrients balance. Although the potential for retention of K increases with biochar application rates but overall, its availability to crop roots may decrease with time (Figure 1). This effect will necessitate complementary alternatives for crop production in biochar-amended soils. Proper biochar-potassium management can affect isoflavonoid content of edamame (Glycine max Merr) and in turn affect nodulation on its roots, seed yield and quality.

A new 3-year research was conducted at the same plots of earlier experiment starting in 2016. This project is continuation of earlier experiment and will study the mid-term impact of biochar on physical-chemical-and biological of amended soil with biochar. The interactive effects of biochar and potassium application on soil health and edamame seed yield and quality is also a focus of this experiment. Treatments include five rates of biochar; 0%, 2%, 4%, 6%, and 8% by weight of soil (equivalent to 0, 40.5, 81.1, 121.5, and 162.0 Mg/ha, respectively) which applied to the research site in 2012. Each plot is randomly divided into two potassium fertilization rates of 0 and 60 kg K_2O ha^{-1} applied as KCl. Edamame seeds were planted on June 2nd. Seeds were inoculated with proper rhizobium prior to planting. Selected characteristics of soil at the beginning of the experiment are presented in Table 1.

Measurements include:

1.) Soil Acidity (pH), Electrical Conductivity (EC) and Cation Exchange Capacity (CEC) determination

2.) Soil Bulk Density (BD), Water-Filled Pore Space (WFPS), Water Holding Capacity, and soil compaction

3.) Nutrient status in soil and plant tissues

4.) Isoflavonoid concentration in plant tissues

5.) Determination of yield, yield components, and nodulation of edamame

6.) Soil organisms activity

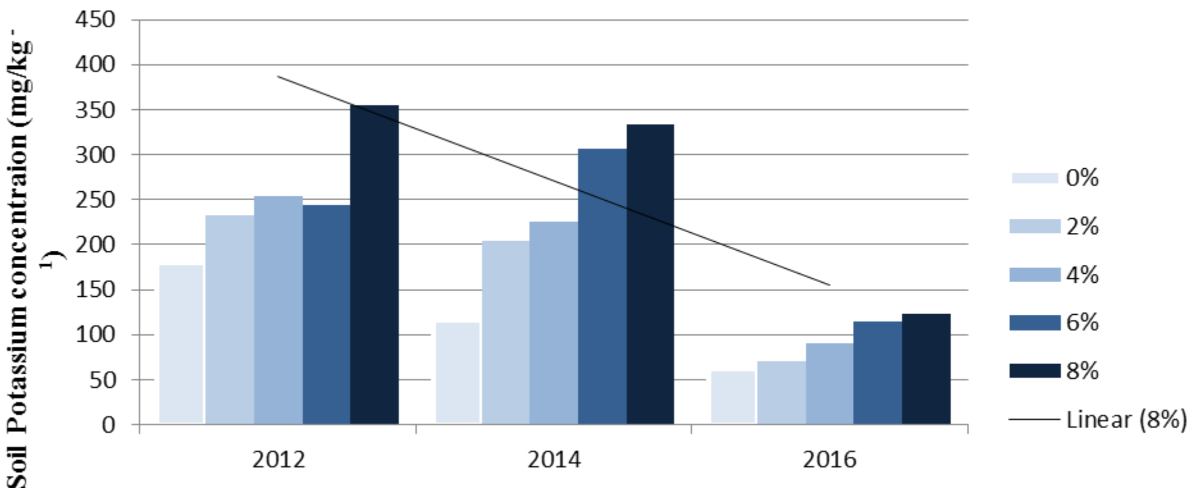

Figure 1: Biannual soil assessment of potassium in soil in biochar-amended field plots (0%, 2%, 4%, 6%, and 8% by weight of soil ,respectively)

Table 1: Selected soil chemical characteristics at the beginning of the second term experiment in 2016.

Bio-char ap-plica tion rate (%)	**P** (ppm)	**K**	**Ca**	**Mg**	**S**	**B**	**Mn**	**Zn**	**Cu**	**Fe**	**Al**	**pH** (1:1 H_2o)
0	**11.5**	**58**	**1152**	**84**	**13.8**	**0.2**	**6.0**	**1.5**	**1.8**	**6.4**	**75**	**5.8**
2	**10.1**	**61**	**1256**	**84**	**14.1**	**0.2**	**5.5**	**1.2**	**1.7**	**5.2**	**76**	**6.0**
4	**11.1**	**90**	**1430**	**101**	**14.5**	**0.3**	**6.2**	**1.3**	**1.5**	**4.6**	**66**	**6.3**
6	**12.4**	**114**	**1362**	**104**	**15.9**	**0.4**	**7.2**	**1.5**	**1.5**	**4.4**	**67**	**6.3**
8	**11.6**	**123**	**1465**	**99**	**15.6**	**0.3**	**6.7**	**1.3**	**1.7**	**4.6**	**69**	**6.5**

Enhancing sustainability and resiliency of apple orchards in New England through cover cropping

Hoveizeh Karimi, Wes Autio, Masoud Hashemi

Poor soil health including soil compaction between tree rows, waterlogging, low soil organic matter, and low population and diversity of beneficial organisms is the common challenge among the apple orchards in New England. Cover cropping is being considered as a powerful conservation tool that can change soil habitat by serving natural soil fertility enhancement, improvement of water infiltration capacity through creating channels in the soil, increasing soil organic matter and thus microbial population and activities. This project use two separate experiments to study different cover crops and cover crop mixes, as a ground cover in newly established and mature apple orchards, in order to improve soil health and midterm effects of cover cropping on apple tree growth and productivity.

In Experiment 1, impacts of different cover crop mixes include: forage radish/ forage radish+crimson clover/ forage radish+crimson clover+oat/ control, as pre and post-plant strategies on optimizing soil nutrients status and soil microbial activities, and improving soil health for planting apple trees will be investigated. Also, this study will assess impacts of different cover cropping scenarios in apple tree nutrition and growth, which will result in to determine the optimum cover crop mixes. In Experiment 2, three treatments of annual spring/fall cover cropping scenarios include: spring: winter rye+ white clover, fall: forage radish/ spring: follow, fall: forage radish/ spring: follow, fall: follow, will be planted between tree rows in a mature apple orchard, in order to assess the effectiveness of forage radish cover crop rotations on water infiltration rate, alleviating soil compaction and waterlogging.
Results will provide insight into managing cover crops in orchard floor management, and will expand New England growers' knowledge and ability to successfully implement cover cropping.

Integrated cover crop and no-till system for improved weed suppression, soil quality and forage rape yield

Parisa Akbari, Stephen J. Herbert and Masoud Hashemi. Stockbridge School of Agriculture

The use of cover crops followed by a main crop and tillage management are known to increase soil quality and crop production by improving soil organic matter content, weed suppression as well as soil biological processes. Cover crop sowing date could have a critical role in the recovery of nutrient and help to control weed growth. Early spring crops may take an advantage of these benefits. Specifically, high nitrogen demanding crops such as forage rape may benefit from nitrogen released from rapidly decomposing cover crops residues, benefiting the environment and with positive effects on the succeeding crop yield.

A two-year study was designed to evaluate the influence of four common cover crops grown in the northeast including two cold tolerant (hairy vetch and winter rye) and two winter kill (oats and forage radish) planted in six dates in a no-till system.

Measurements include assessing weed population, forage rape yield and quality. The synchrony of nutrient release from decomposing cover crops residues and nutrient uptake by forage rape will be evaluated. Data from this research will able to be used to develop an innovative production system for forage rape to take full advantage of the benefits of cover crop planting and a no-till system.

Nitrogen contribution of cover crops in tilled and no-till grass-legume mixtures in sustainable sweet corn production

Parisa Akbari, Stephen J. Herbert and Masoud Hashemi, Stockbridge School of Agriculture

There is an increased interest in integrated cover crops and no-till production systems due to enhancement of soil health and reduced cost of crop production. Sweet corn has an important economic and ecological relevance in the Northeast region, where tillage and herbicide application are still a common practice. In New England where considerable rainfall occurs in the period between soil preparation/planting and rapid phase of plant growth, a large portion of nitrogen will be lost by leaching to the soil below the root zone. Many farmers traditionally over-fertilize corn fields to compensate for such nitrogen losses. This approach affects farm profitability and increases the risk of environmental nonpoint source pollution. Therefore, cover crop planting is necessary for conserving nitrogen over winter and early spring to assure an adequate crop yield and in respect for the environment. In cropping systems, cover crop nutrient availability depends on a more or less rapid mineralization of the cover crop residues, which makes nutrients progressively available to the following crop.

In a two-year experiment, we will study an over wintered grass (rye) and legume (hairy vetch) and winter kill grass (oat) cover crops in pure stands and grass-legume mixtures to quantify nutrients contribution of cover crops to the next crop (sweet corn) in tilled and no-tilled systems. The mixtures will be designed with two different hairy vetch seed rates to explore the possibility of reducing the seed cost when using legume cover crops in the Northeast region. The nutrient accumulation in cover crops in early spring and the decomposition and nutrient release patterns of cover crop residues will be determined when planted with sweet corn in tilled and no till systems. We will also evaluate the effect of killed mulch of cover crops that remain on the soil surface by using roller crimper for increased control of weeds. Data from this research will enable the development of an innovative production system for early sweet corn taking full advantage of the benefits of cover crops.

Ongoing Malt Barley Production Research Projects at the University of Massachusetts, Amherst.

Caroline Wise and Masoud Hashemi

Public interest in sourcing local foods has extended into beverages, and the current demand for local brewing and distilling ingredients is quickly increasing. One new market that has generated interest of both farmers and end-users is malted barley. This only stands to reason since the Northeast alone is home to over 175 microbreweries and 35 craft distillers. Farmers in the Northeast have long grown barley for animal feed on dairy farms, but they lack local knowledge, research information, and resources on how to produce barley that meet rigorous malting specifications. With any new crop there is a steep learning curve and therefore farmers must learn how to implement best agronomic practices combined with proper harvest and post harvest techniques to meet malt standards. Therefore the goal of this project is to enhance the capacity of farmers to produce high quality malt barley to meet the increasing

demand from end-users.

Date of Planting and Nitrogen Trial

A two-year trial is examining the impact of date of planting and nitrogen application timing in fall and spring on winter survival, grain yield and malt quality indices at the U Mass South Deerfield Research Farm. In both years the winter barley cultivar 'Wint-Malt' was planted on the 5th, 15th, and 25th of September (2014 and 2015). Within each planting date, the presence or absence of a fall nitrogen application (25 lbs/ac) was combined with 3 spring nitrogen applications (25, 45, and 65 lbs/ac) for a total of six nitrogen regimes tested in 2014-2015 and seven (a zero nitrogen regime was added) in 2015-2016. In the first year of the trial, earlier planting dates had numerically higher yields than later planting dates, However the earlier planting dates suffered higher foliar diseases, primarily powdery mildew. Deoxynivalenol (DON, aka 'vomitoxin') was lower in earlier planting dates than later. While lower protein percentage was measured in the later planting dates, protein levels of all barley grain in all planting dates were lower than 10% which is considered an acceptable range. Fall nitrogen applications had no significant impact on any of the quantified metrics. Larger applications of nitrogen in the spring resulted in increased yields, however higher foliar disease was associated with the highest rate of application. Although protein levels increased with increased spring nitrogen application rates all harvested grains were in the acceptable range for malting purpose. In the second year of the trial later planting dates have numerically increased winter survival and yield, and spring nitrogen application have numerically increased test weight. More detailed results will be released from UMass as statistical analysis of the harvest data and malt quality characteristics are completed.

Impact of Legume Cover Crops and Seeding Rates in Winter Barley

In July of 2015 four legume cover crop treatments (Sunn Hemp, Crimson Clover, Sunn Hemp+Crimson Clover and no cover crop) were planted in the UMass South Deerfield Research Farm. In early September the cover crops were flail mowed, incorporated and 2 weeks later, 'Wint-Malt' and 'Charles' were planted into the residues at 300, 350, and 400 seeds per m^2. Soil samples were taken at frost, and showed the highest soil nitrate levels in the Sunn Hemp treatment, followed by Sunn Hemp+Crimson, then Crimson Clover, then None. These fall soil nitrate levels appear to correlate numerically with mean height, lodging, and harvest weight. More detailed results will be released from UMass as statistical analysis of the harvest and spring soil nitrate data is completed.

Versions of this trial have been replicated at both the University of Vermont and by Matt Zarif of Stone Cow brewery, in Barre MA. Harvest at the Stone Cow brewery was completed on August 16th 2016. More detailed results will be released as statistical analysis of the harvest data is completed.

Winter Cultivar Trial

Twenty-seven cultivars were tested from 2015-2016 at the U Mass South Deerfield location, as a part of a multi-university winter cultivar trial, organized by the University of Minnesota. At the south Deerfield location Strider (check), Throughbred (check), 04ARS640-1 Endeavor / 98Ab11993 (USDA) and 10.0777 (OSU) had the numerically highest winter survival ranking (all 9 on a 0-9 scale), whereas DH130718 (OSU, 0.3) and DH130004 (OSU. 2.0), were the lowest and the only cultivars rated below an 8. Calypso (Limagrain) had the numerically lowest foliar disease ranking (0.83) of all cultivars tested, and MW11S4029-002 (U. Minnesota) had the highest (6.83). DH130718 (OSU) numerically had the lowest lodging/stem breakage ranking (1), whereas Vincenta (Ackermann) had the highest (6.83). DH130718 had the numerically lowest yield of all cultivars tested, and Calypso had the highest.

Spring Cultivar Trial

Twenty-five cultivars were tested in 2016 at the U Mass South Deerfield location, as a part of a multi-university spring cultivar trial, organized by North Dakota State University. At the South Deerfield location Cerveza (Agriculture and Agri-Food Canada) had the numerically lowest foliar disease ranking (1.5) and Tradition (Busch Agricultural Resources, LLC) had the highest (7.5). Numerically Cervez had the lowest stem breakage (17%), while Conlon had the highest (77%). However, Conlon also suffered the highest weed pressure (8.33 on a 0-10 scale), while Newdale (Agriculture and Agri-Food Canada) suffered the lowest (3.67). The trial overall suffered significantly from heavy weed pressure. Harvest occurred on August 8th, 2016 and harvest analysis is ongoing at this time.

A Second Season: Hardy Winter Grains Harvested for Spring Feed

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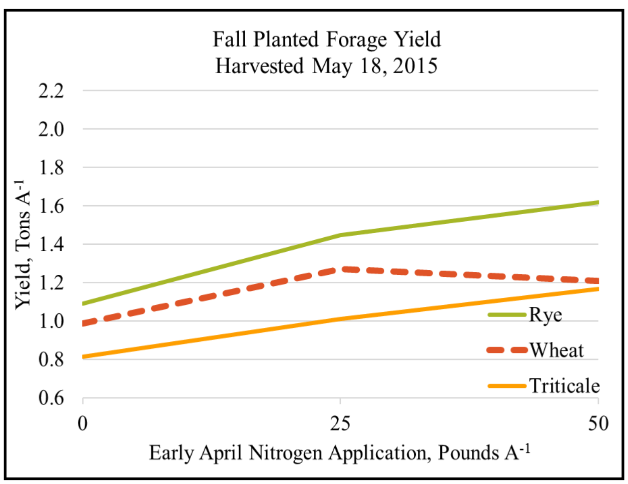
Early winters and long, wet springs often result in only one major growing season for Massachusetts dairy farmers reliant on corn silage as their primary source of feed. Hardy winter grains rye, wheat, and triticale, a rye-wheat hybrid, withstand the winter to grow rapidly in the spring and offer a May harvest for baleage or haylage before corn is planted. These crops should be seeded at 100-110 lbs. A^{-1} when using a grain drill, or 150-200 lbs. A^{-1} when broadcasting and rolling or tilling in lightly.

On-going research indicates these crops should be planted by September 15 to achieve desired spring yields. To accommodate this planting date, early or mid-season corn varieties should be planted in place of full-season corn. Risk of yield penalty associated with shorter-season varieties is low. Spring harvests in 2015 and 2016 plus average shorter-season corn yields provided increased, overall production in the double crop system compared to full-season corn alone.

Corn pulled off in late August or early September also allows for early manure application and compliance with MA manure and nutrient management regulations. Winter grains planted after manure application and incorporation capture and cycle manure nitrogen and phosphorous. The earlier the crop is planted, the more time it has to capture N and P and put on fall growth before going dormant. Winter stands of these crops protect the soil, and the residues following the spring harvest build soil organic matter. In the face of both summer and winter weather extremes, as well as volatile milk prices, a second season can provide stability and resiliency, both economically and environmentally.



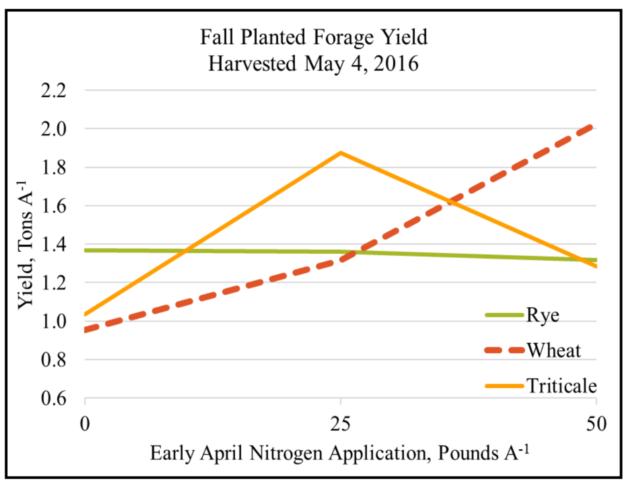


Figure 1 and 2: Rye, wheat, and triticale spring dry matter yields A^{-1} as influenced by nitrogen. Crops were planted at the UMass Research Farm in Deerfield, MA using a grain drill on September 1 following manure application and incorporation.

Differences between 2015 and 2016 yields (**figures 1 & 2**), as well as crop responses to spring nitrogen fertilizer, illustrate variation likely influenced primarily by weather. In 2015, rye provided the greatest spring yield and the strongest response to nitrogen, likely due to the long, harsh winter. However, wheat was the greatest yielder in 2016 at 50 lbs. A^{-1} N. Rye showed no nitrogen response in this year, suggesting wheat had the advantage in the mild winter and began rapid spring growth. However, in both 2015 and 2016 rye was a dependable yielder producing 1.1 and 1.4 tons A^{-1} dry matter with no nitrogen inputs. Interestingly, in 2016, triticale peaked at an average of 1.8 tons A^{-1} dry matter at 25 lbs. A^{-1} N, well above rye and wheat yields at this rate of fertilizer application, but triticale dropped production to 1.3 tons A^{-1} dry matter at 50 lbs. A^{-1} N. This data suggests the importance of selecting a crop and fertilizer program appropriate for both the field and farm, and taking long-term forecasts into consideration.

These crops will be planted again this fall for a third year of study on the UMass Research Farm in Deerfield, MA. Crops in this study in 2015 and 2016 were Prima winter rye, organic NE426GT winter triticale, and Arapahoe winter wheat. This fall we will also begin three on-farm trials in the state, in Deerfield, Sunderland, and West Brookfield, in which we'll test additional wheat, rye, and triticale varieties for yield potential, feed value, and milk value. Seeds in this study and upcoming on farm trials were purchased from Albert Lea seeds in Albert Lea, MN, and the Greenfield Farmers Co-op in Greenfield, MA.