UMass Agricultural Field Day






Tuesday, July 29th

10:00am-4:00pm

Crop and Animal Research Farm

89-91 North River Road

South Deerfield, MA

- **Sustainable Farming**
- **Integrated Pest Management**
- **Intercropping Systems**
- **Innovative Soil Amendments**
- **Energy-Efficient Food Storage**
- **Crop Trials**
- **Horse Power**
- **and more...**

UMASS AMHERST

The Center *for* Agriculture, Food and the Environment

Todays guided tour will include:

Welcome to the 2014 UMass Agricultural Field Day

This event has been made possible with support from:

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For more information please visit: www.equiculture.org

UMass Student Farming Enterprise Program

Blocks 20, 21, 23, 26

Amanda Brown, Ruth Hazzard, Jason Silverman, Ian Back, Eli Bloch, Duncan Fuchise, Benjamin Goudreau, Christopher Raabe, Nicolle Taniuchi

Rationale: The UMass Student Farming Enterprise program is a year-long course offered through the Stockbridge School of Agriculture that offers students hands-on experience, managing all aspects of a diversified vegetable farm. The course is offered in both the spring and fall semesters with a summer farming component at the farm. It has been developed and taught by vegetable specialists Ruth Hazzard and Amanda Brown.

Goals: To provide students with the necessary skills to operate an organic vegetable farm on their own. To help train the next generation of farmers.

Results: Now in its eighth season the program has graduated over 80 students who have gone on to start farms of their own, taken managerial positions on farms or found work with various non-profit agencies.

Thank you to our sponsors:

STOCKBRIDGE SCHOOL of AGRICULTURE | UMASS AMHERST

Big Y

Energy Efficient Food Storage Systems

Luke Doody, Ben Weil

Rationale: The market for local produce over the winter months is growing as winter CSA's and winter farmer's markets increase in popularity. To meet this growing demand, farmers must be able to economically store produce for extended periods of time while maintaining produce quality. With these criteria in mind, we set out to design and implement a working cooler that is more energy-efficient and has an improved storage environment over conventional cooler models.

Research Goals: Our goals are to develop energy-efficient food storage systems. Research thus far has been focused on using outdoor air and evaporative cooling to store produce that is ideally stored at cold temperatures and high relative humidity levels. Produce of this storage category includes, but is not limited to: carrots, turnips, beets, cabbage and parsnips. Many farmers in New England already take advantage of the cold outdoor air temperatures during the storage months of October through March to reduce energy use. However, outdoor winter air is very dry and creates a storage environment that can cause weight loss, shrinkage and decreased produce quality. By introducing humidity into the storage environment via a centrifugal humidifier, we aim to improve the storage environment for the produce while also taking advantage of evaporative cooling to extend the number of hours of "free cooling" that are available.

Treatments: We began research in the late winter of 2013 to establish the effectiveness of evaporative cooling in New England winters. We ducted outdoor air into two controlled test huts, one of which had a Humidisk 10 Centrifugal Humidifier and the other was left empty. In this experiment we were able to establish the outdoor temperatures needed to achieve acceptable refrigeration temperatures.

With the data gathered in our first experiment, we implemented a full-scale working model of the Evaporative Cooling Enhanced (EvapEnhanced) System on an 8ft X 8ft X 8ft walk-in cooler where we stored produce over the following winter season of 2013-2014. The prototype cooler was fit with an outdoor fan that operated on two thermostats. One thermostat read outdoor air temperature and was set to turn on bellow 45˚F and the second thermostat read the internal cooler temperature and turned on when temperatures reached 34˚F and off at 32˚F. The mechanical direct expansion (DX) cooling system of the cooler was wired through another thermostat that eliminated the need for the evaporator fan to run constantly. The DX system was set to turn on when internal temperatures reached 38˚F and off at 33˚F. A 70 CFM fan was used to circulate air when there was no need for the evaporator fan to operate. The same Humidisk 10 Centrifugal Humidifier was used as in our previous winter's experiment.

We collaborated with Simple Gifts Farm in North Amherst, MA and filled our cooler with root vegetables for their winter CSA shares. We also stored carrots that were measured monthly for weight loss and sugar content in both our cooler and a similar cooler at Simple Gifts. Temperature, relative humidity and energy usage were measured throughout the winter at both locations and compared.

Results: From our first set of experiments we were able to determine the number of hours of "free cooling" available using outdoor air only and using outdoor air with evaporative cooling (figure 1). With our EvapEnhanced system we were able to maintain a quality storage environment with relative humidity near 100% (figure 2). During this time, outdoor temperature was extremely variable and had little effect on the state of the cooler.

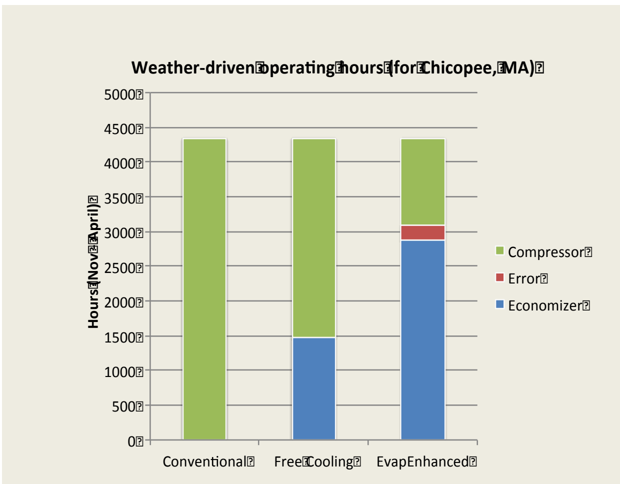


figure 1

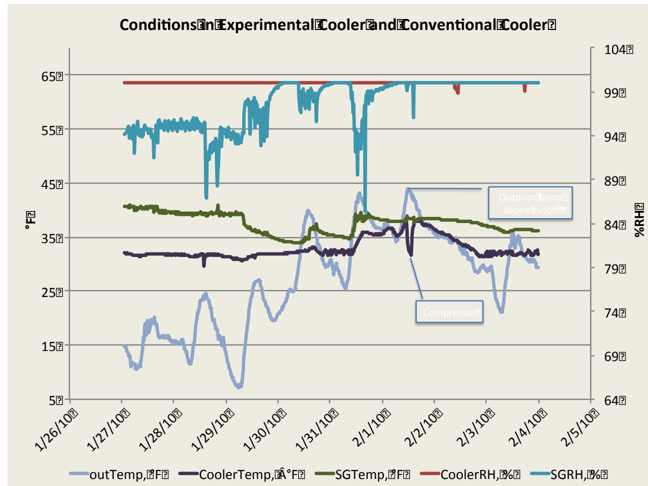


figure 2

From our working model we were able to calculate the energy usage of our Evaporative Cooling Enhanced cooler compared to that of a conventional cooler. The conventional cooler used an average of 5 times more energy than our EvapEnhanced model (figure 3). Based on weather data from the Chicopee, MA weather station, we calculated the estimated energy usage and operating costs of our system compared to conventional and "free air" only system (figure 4). The "free air" system has an estimated annual energy savings of $122. Our EvapEnhanced system has an estimated annual energy savings of $213 (figure 5). Humidifier savings are probably bigger at larger scales as our cooler was only 512 ft^3 and the mechanics of our set up can be applied to a cooler with a volume of 12,000 ft^3. These cost savings do not reflect the improved quality and weight retention of the produce. It can be assumed that with increased quality there will be increased marketability and therefore increased revenue.

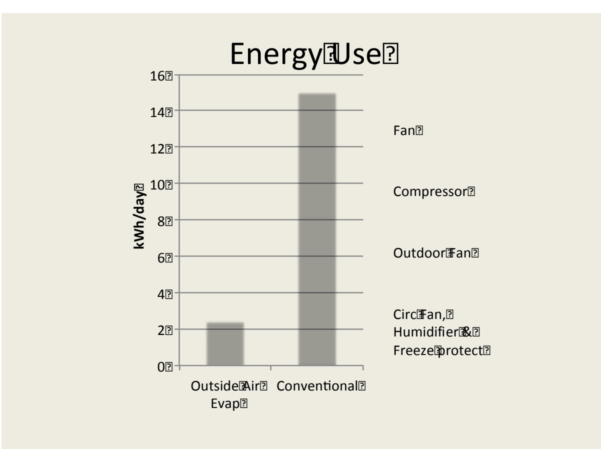


figure 3

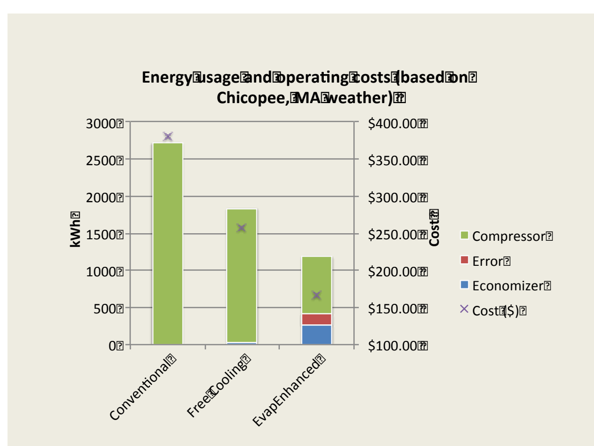


figure 4

First Cost and Simple Payback Period

Item	Cost	Economizer only
Humdifier	$900	N/A
Air intake fan	$200	$200
Circ. fan	$40	$40
Misc.	$100	$100
Total	**$1,240**	**$340**
Savings	*$213*	*$122*
Simple Payback	**2.91 Years**	**2.78 Years**

figure 5

Cold storage unit in South Deerfield, MA

Many thanks to Simple Gifts Farm, The UMass Student Farm, The South Deerfield UMass Research Farm, UMass Agricultural Extension and the USDA for their support to this project.

Publications will be made available in the coming months regarding this research. Further research is expected focusing on efficiently meeting the storage needs of other crops that are ideally stored in warm/dry and warm/humid environments.

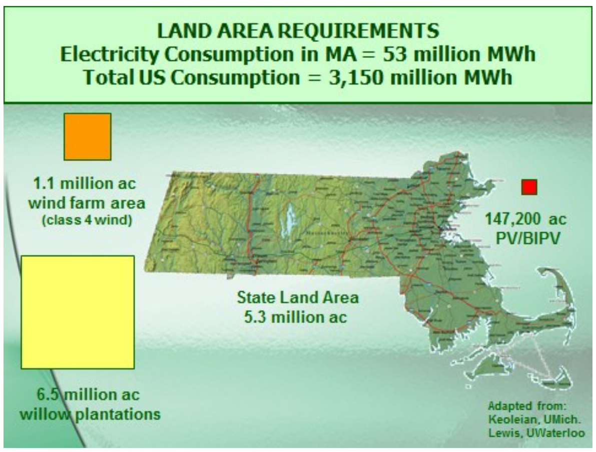
Please direct any questions, comments or ideas concerning crop storage infrastructure, energy efficiency and construction to Luke Doody at: ldoody@eco.umass.edu

Agriculture and Solar Energy Dual Land Use

Block 29

Stephen J. Herbert, Phaedra Ghazi, Kate Gervias, Emily Cole and Sara Weis
Stockbridge School of Agriculture

Rationale: This Research Project is grounded in the understanding that there is a need for sustainable renewable energy sources for Massachusetts and the U.S. and we suggest solar power as an area of great promise. The map below compares how much land would be required to power Massachusetts with three forms of renewable energy. Only solar has the potential to substantially power the state while only using a reasonable amount of the state's land mass. Traditional ground mounted solar installations on farmland, however, remove arable land from potential agricultural use.



Research Goals: This project is exploring raised solar panels that enable use of the field under the solar panels as pasture as shown in the right figure above. The goal is to provide farmers and installers of solar PV options for installing solar arrays on farm fields without taking the field out of production.

Treatments: In the project's first phase, installation techniques were developed as 106 panels were installed in livestock pasture areas. New techniques were developed to install (drive) poles with no disturbance to the soil or crop underneath. At the same time, methods were developed to create stable structures without the use of large concrete bases which would have also created excess disturbance to the soil. Panels were installed about 7.5ft (2.3m) off the ground with spaces between panel clusters varying from 2 to 5ft. An experimental test site for dual use of land for photovoltaic and agricultural production has been proposed to demonstrate the feasibility of growing field crops under solar panels. The site would be available for applied field studies for vegetable and field crops.

Results: The research examined effects of panel spacing and panel placement while continuing agricultural use of the underlying ground. Initial results suggest a space of 3.5 to 4.0ft (1 to 1.2m) is needed between panel clusters to maintain 90 to 95% of the pasture yield without shade from solar panels.

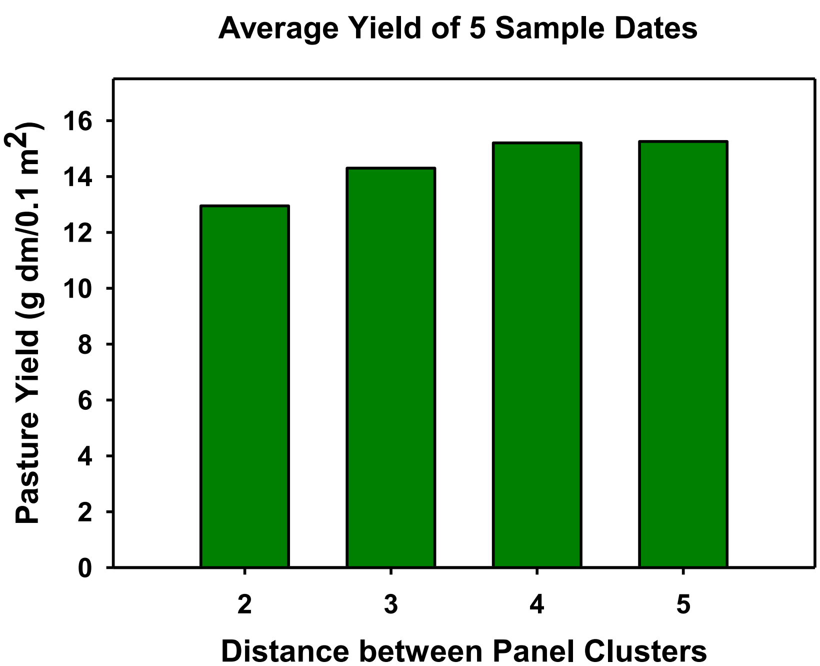
The proposed experimental test site is as follows (as well as in the schematic below): 3 rows x 4 panel cluster spacing x 3 clusters/spacing x 4 replications (4 panels/cluster)

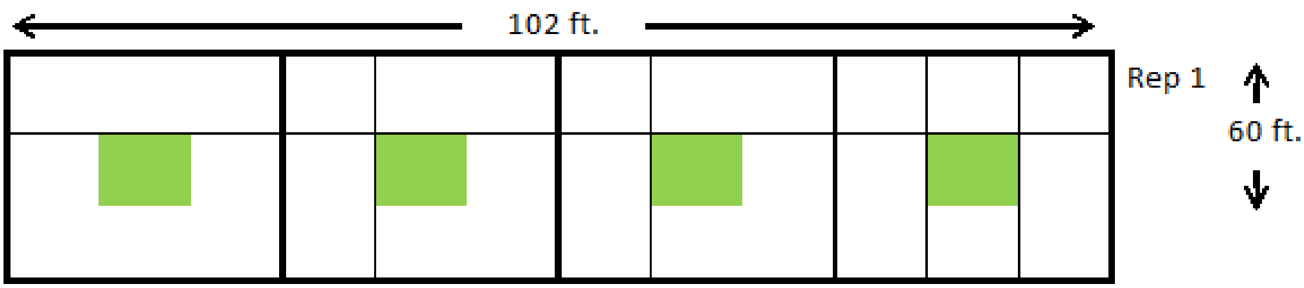
Total clusters = 144

Total panels = 576

Approx. 144 KW

Proposed panel cluster spacing treatments are 1.5ft, 2.5ft, 3.5ft, and 4.5ft. (45cm, 75cm, 105cm, and 135cm) plus control areas without panels.





Green-shaded areas represent plot areas (panel cluster plus spacing between adjacent bordered by the same spacing between panel clusters (one rep of 4 planned). Minimum height of the lowest part of panels above the soil surface would be 10ft (3m) to allow movement of tractors and farm equipment. It is hypothesized that different vegetable crops may have varying spacing requirements although a somewhat optimum spacing might be similar and achievable for many vegetable crops. A preliminary evaluation of vegetable crops is currently underway in the existing installation.

We thank the Center for Agriculture, Food and the Environment, Diversified Construction, LLC, the Massachusetts Society for Promoting Agriculture, and the UMass Physical Plant for their support in this project.

Evaluation of Organic Sources of Nitrogen for Production in a High Tunnel

Block 20

Frank Mangan, Zoraia Barros, Aline Marchese and Viviane Barros

Rationale: Since there are limited sources of soluble organic nitrogen, many farmers will load up their nitrogen at the beginning of the season, especially when using plastic, due to the difficulty of applying nitrogen to the soil under plastic. This is in contrast to conventional farmers for whom there are many options for soluble sources of nitrogen that can be applied readily through drip irrigation.

We are comparing to organic sources of nitrogen, compost and feather meal, to a soluble source of nitrogen called "SN14". It is a product derived from "vegetable-based amino-acids" and is 14% nitrogen. We decided not to use Chilean nitrate, which is also a soluble form of organic nitrogen, since it was expected that this nitrogen source was going to lose its OMRI certification. (as of July 2014 it is still OMRI certified)

Research Goals: To evaluate three sources of nitrogen in a certified organic high tunnel

Treatments:

Compost(ton/A)	Feathermeal (lbs/A)	SN-14 (lbs/A)
0	0	0
10	30	30
20	60	60
40	120	120

Poblano peppers in the high tunnel on July 31, 2013

We thank the Center for Agriculture, Food and the Environment for their financial support.

The Center for Agriculture, Food and the Environment

For more information contact Frank Mangan, fmangan@umass.edu; (508) 254-3331

Establishing a Cost-Efficient Seeding Rate for Hairy Vetch as Cover Crop

Block 24

Masoud Hashemi, Sarah Weis

Rationale: Hairy vetch is a winter hardy, annual legume, and its ability to fix nitrogen makes it very useful in vegetable crop rotations. Although the inclusion of hairy vetch in a crop rotation could be advantageous to a farmer, the least expensive seed we could find was $110.00/50 lbs. Due to the high cost of seed we wanted to identify the optimal seeding rate to ensure that farmers would be maximizing on yield and the associated return of nitrogen.

Research Goals: We are currently conducting research on hairy vetch in order to identify the optimal seeding rate for economic benefit in nitrogen contribution, and also to measure the decomposition rate to determine when the contributed nitrogen is likely to become available to subsequent crops.

Treatments: In the fall of 2013 we planted hairy vetch at five different seeding rates (5, 10, 20, 30, and 40 lbs. per acre) on two different dates of planting; September 11, 2013 and September 24, 2013. We collected samples of the vetch this May, and will be analyzing them for yield and nutrient content. After sample collection, the vetch was flail mowed, disced under the soil surface, and corn was planted on June 7, 2014. We collected soil samples from each plot when the corn reached approximately 12 inches, and we analyzed those to find the amount of nitrogen that is available to the corn relative to the amount of vetch that had been planted.

Results: Figure 1 shows vetch yields in 2013 and 2014 from vetch plantings in fall 2012 and 2013. Note the growth that took place between May 6 and May 30 in 2013. This growth contributed greatly to dry matter and to total nitrogen. Yield in early May 2014 was greater than in 2013. Nitrogen comprises about 3% of the dry weight of vetch.

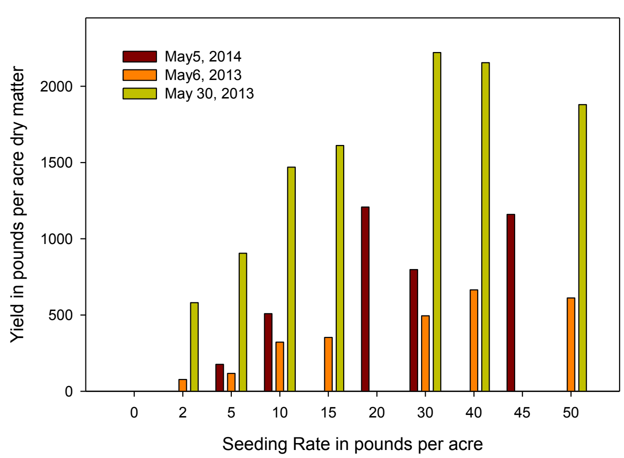


Figure 1. Yields of vetch from 2012 and 2013 plantings.

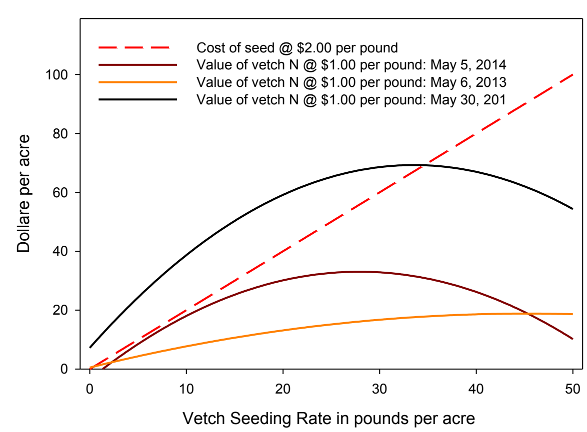


Figure 2 Seed cost vs nitrogen contribution of vetch

Figure 2 shows the fertilizer dollar value of the nitrogen (valued at $1.00 per pound N) contributed by the vetch at the harvest times shown, and compares this value to the cost of the vetch seed at $2.00 per pound used to plant the area. Only where the "value of vetch" line is above the red-dotted "cost of seed" line is there a positive return in nitrogen cost. Our data, therefore, suggest that allowing the vetch extra time for growth is a positive action and the data also suggest that the added expense of planting much more than 30 pounds of vetch removes the positive financial benefit. While we do not have data for late May vetch yield in 2014, the vetch was not flail mowed until the end of May, thus contributing to the "stock" of soil nitrogen. Figure 3 shows that there was significantly more nitrogen available for the corn crop in the plots which had vetch growing prior to corn. If corn side-dress fertilizer recommendation is 150 lb/acre for the "b" group and 125 lb/acre for the "a" group from Figure 3, then vetch cover crop would save $25.00 an acre in side-dress nitrogen cost, covering up to 12.5 lb of vetch seed. Don't forget that vetch is also adding to organic matter!

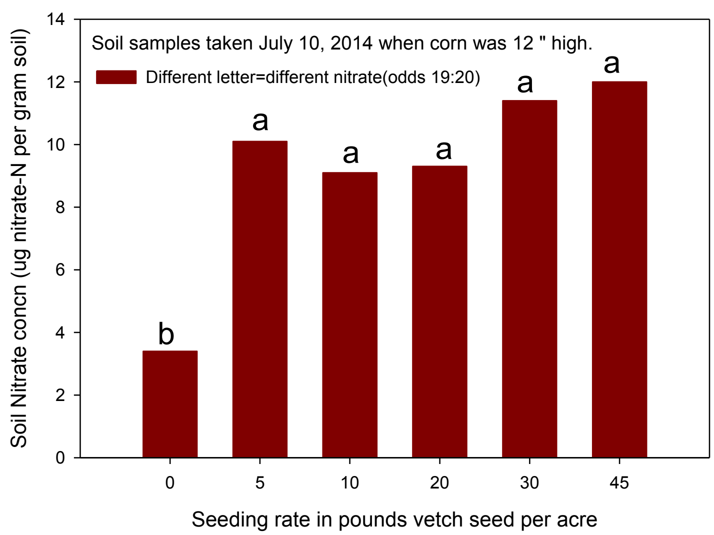


Figure 3. Nitrate availability for 2014 corn influenced by fall 2013

For further information you may contact Masoud Hashemi: masoud@umass.edu

Cover Crop and Nitrogen Management for Sustainable Potato Production

Block 24

Emad Jahanzad, Allen V Barker, Masoud Hashemi, Touria Eaton, Amir Sadeghpour

Rationale: Potato is an important crop in the United States and rates fourth among world crops in terms of production. There are over 2700 potato fields in the Northeast United States and potato growers often over-apply nitrogen fertilizer to ensure against loss of yield. High mobility of nitrate in the soil profile makes it susceptible to leach to the lower soil levels leading to ground water contamination and environmental concerns. Regardless of costs of fertilizers, nitrate-contaminated water causes serious illnesses for infants and pregnant woman which could not be tolerated by public. Obviously, nitrogen management practices which adjust nitrogen fertilizer application are necessary to reduce nitrate contamination of water resources. Management practices such as tailoring nitrogen fertilizer rates and selecting appropriate type of cover crops, as nitrogen scavengers, in rotation with potato can not only reduce nitrate leaching but enhance profitability by cutting fertilizer costs in potato production. By scavenging such large quantities of nitrate, cover crops contribute to protecting water quality and decrease enormous health care costs caused by nitrate contaminated water. In addition, cover crops can provide nutrients for the following crop, increase soil organic matter, reduce soil erosion, suppress weeds, and enhance wildlife habitat.

Research Goals: The objectives of this study are to 1) Evaluate influence of different cover crop mixtures on minimizing nitrate leachate caused by excess nitrogen fertilizer application 2) Assess cover crops' decomposition rate and its synchronization with potato nutrient demands 3) Study nutrient density and tuber yield of potatoes as affected by cover crop mixtures and nitrogen fertilizer.

Treatments: Treatments include five cover crop mixtures: oat/peas, rye/peas, daikon/peas, daikon/rye, daikon/oat, along with no-cover crops, and four nitrogen fertilizer rates (0, 50, 100, and 150 Ib/N/A). This experiment will be repeated in 2014-2015 cropping season.

Results: They first year of this study is ongoing and the covercrop and soil samples are being analyzed in the lab. Potato tubers will be analyzed after harvest to determine yield, nutrient density, and tuber quality parameters.

Planting Cover crops, Sep 2013

Cover crop plots, Oct 2013

Cover crop plots, Nov 2013

Winter killed plants, Mar 2014

Planting potatoes, May 2014

Potato plots, July 2014

This research is funded by Sustainable Agriculture Research and Education program (SARE).

SARE
Sustainable Agriculture
Research & Education

For more information contact Emad Jahanzad: ejahanzad@psis.umass.edu

Integrating Pig and Vegetable Production

Block 27

Frank Mangan, Kyle Bostrom, Zoraia Barros, Aline Marchese and Viviane Barros

Rationale: This trial was initiated in order to evaluate the intercropping of animals and vegetable crops. There has been an increased demand for locally-grown meats and at the same time there are vegetable farmers who are looking for sources of manure for fertility and to diversify their operations. Thirdly, the regulations for using fresh manure when growing fresh produce is becoming more regulated, in particular at it relates to Good Agricultural Practices (GAP).

Research Goals:

- Evaluate rotations and economics of this system
- Evaluate implications of this system on Good Agricultural Practices (GAP) certification

Treatments:

Crop schedule (see map of field on next page)

- Cover crops planted on Sept. 24, 13
  - ½ acre to hairy vetch (20 lbs/A) and winter rye (56 lbs/A)
  - ½ acre to winter rye (112 lbs/A)
- Rye plowed on June 2, 2014
- Squash[1] planted on June 6, 2014.

Timeline of pig production

- Pigs born first week of April at Parsons Farm in Hadley MA
- Pigs brought to the UMass Research Farm on May 14 for quarantine
- Pigs moved to rye plot on May 19
- Pigs moved to vetch and rye plot on June 1

Hard squashes on July 8, 2014

Pigs on July 8, 2014

[1] Kabocha and abóbora japonesa

We thank the Center for Agriculture, Food and the Environment and the Massachusetts Department of Agricultural Resources for their financial support.

For more information contact Frank Mangan, fmangan@umass.edu; 508 254-3331

Establishing the Carbon Footprint in Agricultural Systems

Block 27

Viviane Barros, Frank Mangan, Zoraia Barros and Aline Marchese

Rationale: There is growing interest in reducing the amount of greenhouse gasses that are produced by human activities. It is estimated that agricultural activities, including the transportation of agricultural products from farm to market, is responsible for up to 30% of greenhouse gases released into the atmosphere.

The Brazilian national government has introduced low carbon agriculture policies and established emission reduction targets that require the agriculture sector to substantially reduce their GHG emissions (Federal law Nº 12.187, 12/29/2009). In this context, this project aims to assess the carbon footprint of Brazilian melons, and establish and compare this to the carbon footprint of melons in Massachusetts according to several cropping systems (Conventional, no-till, and organic production.

Carbon Footprint in Melon Production

The Carbon Footprint for melon production and sales is made up of greenhouse gas emissions (GHG) associated with all aspects of producing and selling melons. This will be measured for activities in what is called the Life Cycle Assessment (LCA), which is an assessment tool to measure GHG from the raw materials of all activities in the production and marketing components, and the final disposal of materials used in the production and marketing activities.

Research Goals:

- Evaluate the impacts of agricultural production of melons on climate change considering different cropping systems melon and the life cycle
- Compare the carbon footprint of melons produced in Brazil and shipped to markets in Massachusetts to melons produced in Massachusetts for markets in this state.

Information Needed for this Study

We are selecting the following information from three certified organic growers and three conventional growers of melons:

- All inputs used in the production of seeds, transplant production, melon production in the field, harvest, packing and transport of melons from the farm to market.
- An estimate of labor hours/activity of melon production per a specific unit area.
- An estimate of yield. We'll do this by weighing melons in a specific row-feet. This will not be a destructive harvest – the melons will be weighed and given back to the producer.

Analysis and use of information

The information will be analyzed by a software program called Simapro@, utilized by the Brazilian Research Company (Embrapa/CNPAT) to establish the carbon footprint for specific agricultural production systems. The results of this study will be published in scientific and Extension publications and shared with cooperating farmers.

Commonwealth Quality and Good Agricultural Practices Certification

Zoraia Barros, Frank Mangan, Rich Bonanno, Aline Marchese and Viviane Barros

Rationale:

As part of a grant funded by the Massachusetts Department of Agricultural Resources, the UMass Research Farm, located in Deerfield MA, is going through the process to become certified for both Commonwealth Quality and Good Agricultural Practices programs. We will make the UMass Farm available to any farmers and professionals who want to learn more about these certifying programs and the process our farm is using to become certified. The UMass Research Farm, which has both certified organic and conventional land, grows, harvests, packs and markets produce as part of their production and marketing research, in addition to the activities of the UMass Student Farm located in both Deerfield and Amherst.

Research Goals:

Move toward certification for Commonwealth Quality and Good Agricultural Practices (GAP) certification at the UMass Research Farm in Deerfield.

Activities:

Implementation of a food safety plan, including:

- Minimizing Risks: before planting, during production, at harvest and during postharvest handling
- Employee food safety education and training
- Signs - worker facilities and hygiene
- Water source testing

We thank the Center for Agriculture, Food and the Environment and the Massachusetts Department of Agricultural Resources for their financial support

For more information contact Zoraia Barros, zbarros@umass.edu; 413-658-4278

Assessing Commercial Rapid Quality Control Tools for on-Farm Postharvest Sanitation Management

Amanda Kinchla, Vivian Chong, Fatema Abassbhay,
UMass Food Science

Rationale: Agricultural water is a known food source of microbial contamination on the farm. Identifying ways to manage your water usage on the farm is an important way to control food safety risks. This project evaluates commercially available tools that can be used for managing water used in dunk tanks to wash vegetables.

Research Goals: The purpose of this project is to validate commercially available quality control tools to reduce food safety risks using sanitizer in produce wash water.

Treatments: In this study, vegetable puree solutions were diluted to 25 and 50 NTU for each vegetable respectively and autoclaved for further testing. Each solution was tested in triplicate with 100 ml samples, which was then spiked with bleach to a 50 ppm solution, and was tested using two Oxidative Redox Potential (ORP) meters and different commercially-available free chlorine strips to test the amount of free chlorine available.

Results:

- The presence of free residual chlorine will aid in reducing the microbial risks in wash water used to clean vegetables on the farm.
- Some Free Chlorine Test strip products yield inconsistent readings due to the impact of vegetative matter.
- Portable Orion ORP#1 meter and handheld pocket ORP Tester #2 provide consistent results in controls and organic matter solutions. ORP may be a good indicator of sanitizer activity if kept to at least to 650-800 mV range. However vegetation greatly reduced ORP below threshold while main-

CPS "Top FAQs about Produce Wash Water Management for Small-Scale and Direct Market Farms" 2012

Figure 2: Free chlorine test strips

Table 1. Comparison of Averaged ORP Measurements with Reduction of E.coli O157:H7

Wash Solutions	Sanitizer treatments: NaClO (ppm)		Residual Free Cl (Avg Hach)	ORP# 1	ORP# 2	*E. coli O157:H7*
				Target: 650-800 mV		
Clean H2O	Control: 0 NTU	0 ppm	0 ppm	445.6	455	No Reduction
	0 NTU	50 ppm	50 ppm	680.7	701	Total 7 log kill
Soil + H2O	Control: 50 NTU	0 ppm	0 ppm	475.3	457	No Reduction
	25 NTU	50 ppm	25 ppm	693.0	700	Total 7 log kill
	50 NTU	50 ppm	50 ppm	718.8	717	Total 7 log kill
Cucumber + H2O	Control: 50 NTU	0 ppm	0 ppm	350.0	303	No Reduction
	25 NTU	50 ppm	11 ppm	834.9	830	Total 7 log kill
	50 NTU	50 ppm	1.2 ppm	584.3	560	Total 7 log kill
Cucumber + Soil	Control: 50 NTU	0 ppm	0 ppm	381.0	370	No Reduction
	25 NTU	50 ppm	13 ppm	761.6	774	Total 7 log kill
	50 NTU	50 ppm	10 ppm	833.1	816	Total 7 log kill

Table 2: Comparison of Free Chlorine Test Strips in Turbid Organic Matter Wash Solutions

Wash Solutions	Initial chlorine load added to the process wash water	Residual Free Chlorine (ppm)			
		HACH	Fr1	Fr2	Fr3
Clean H2O	0	0 ppm	0	0	0
	50ppm	50 ppm	50	> 10	50
Soil + H2O	0	0 ppm	0	0	0
	25ppm	25 ppm	25	> 10	Between 10-50
	50ppm	50 ppm	50	> 10	50
Cucumber + H2O	0	0 ppm	0	0	0
	25ppm	4 ppm	50	2.0	10
	50ppm	10 ppm	< 25	0.2	50
Cucumber + Soil	0	0 ppm	0	0	0
	25ppm	5 ppm	< 25	2.0	Between 10-50
	50ppm	25 ppm	< 25	0.6	50
Organic Challenge H2O	0	0 ppm	0	0	0
	25ppm	0 ppm	0	0	0
	50ppm	0 ppm	0	0	0

Ranges for each commercial free residual chlorine test strip (ppm):
FR1: 0, 25, 50, 100.
FR2: 0, 0.1, 0.4, 0.6, 0.8, 1.2, 1.5, 2.0, 2.6, 4.0, 6.0, 10.
FR3: 10, 50, 100, 200.

Turbidity was prepared at 50NTU

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, the Massachusetts Agricultural Experiment Station and the Food Science department of the University of Massachusetts Amherst, under project number MAS00440.

If you have any questions regarding this research, please contact Amanda Kinchla, amanda.kinchla@foodsci.umass.edu.

Management of Basil Downy Mildew in Organic Systems

Block 9

Susan Scheufele, Katie Campbell-Nelson, Lisa McKeag, Ruth Hazzard

Rationale: Basil downy mildew (*Peronospora belbahrii*) is an emerging disease which poses a serious threat to basil production in the Northeast region. The disease has occurred every year since it was first reported in MA in 2008 and it will likely continue to be a serious challenge to basil production in New England for the foreseeable future. In organic systems, there are very few fungicides currently labeled for basil downy mildew control, and there is little efficacy data available for those few labeled products. Demonstrating efficacy of materials approved for use in organic cropping systems and expanding product labels is imperative in order to support the region's organic basil growers, and to add new management tools for all basil growers.

Research Goals: The goals of this project are to determine efficacy of OMRI-approved copper fungicides alone and in rotations with the OMRI-approved plant defense activator, Regalia, to control basil downy mildew.

Treatments:

	Treatment	Active Ingredient
1	Untreated	De-ionixed water
2	Regalia	Extract of *Reynoutria sachalinensis*
3	Basic Copper 53	Copper sulfate
4	Badge X2	Copper oxychloride + copper hydroxide
5	NuCop HB	Copper hydroxide (MCE 50%)
6	Cueva	copper octanoate
7	Regalia / Basic Copper 53	Extract of *Reynoutria sachalinensis* / Copper sulfate
8	Regalia / Badge X2	Extract of *Reynoutria sachalinensis* / Copper oxychloride + copper hydroxide
9	Regalia / Kocide 3000	Extract of *Reynoutria sachalinensis* / Copper hydroxide
10	Regalia / Cueva	Extract of *Reynoutria sachalinensis* / copper octanoate
11	Ranman	Cyazofamid

Results: Fungicide applications will be made from August 1 to September 1. Disease severity and marketable yield data will be collected and results will be published on the UMass Extension Vegetable Program website (http://extension.umass.edu/vegetable/), in the Vegetable Notes newsletter, and in Plant Disease Management Reports later this fall.

Symptoms of basil downy mildew on upper (left) and lower (right) surfaces of leaves

Funding for this project was provided by the IR-4 Biopesticide and Organic Support Program and by a grant from USDA NIFA.

The IR-4 Project

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

For more information please contact Sue Scheufele at sscheufele@umext.umass.edu.

Evaluation of Biological and Alternative Fungicides to Control Fall Diseases of Brassicas

Block 9

Susan Scheufele, Katie Campbell-Nelson, Lisa McKeag, Ruth Hazzard

Rationale: Three diseases—Alternaria leaf spot (ALS) caused by *Alternaria brassicicola* and *A. brassicae*, black rot (BR) caused by *Xanthamonas campestris*, and downy mildew (DM) caused by *Hyaloperonospora brassicae*—occur commonly in the Northeast and can significantly reduce quality and yield of all cultivated brassicas. These diseases are especially problematic in long-season, fall-harvested crops such as Brussels sprouts and storage cabbage. The goal of this study is to evaluate efficacy of OMRI-approved pesticides that are labeled for use in controlling the three diseases, but for which efficacy data to support their use is lacking. The study was first conducted in 2013 under low, naturally occurring disease pressure, but this year we will focus on the most common foliar disease, Alternaria leaf spot, and will inoculate the trial to ensure adequate disease pressure to evaluate treatment differences. Effects on BR and DM will also be quantified if symptoms are observed.

Research Goals: To determine the efficacy of alternative fungicides in controlling Alternaria leaf spot, black rot, and downy mildew in cabbage.

Treatments:

Treatment and Rate (/A)[x]	Active Ingredient
Untreated Control……………………	De-Ionized Water
Quadris, 15 fl oz……………………	Azoxystrobin
Regalia, 1 oz……………….	Extract of *Reynoutria sachalinensis*
Serenade Optimum, 20 oz…………	*Bacillus subtilis*
Sonata, 4 qt…………………………	*Bacillus pumilus*
Double Nickel 55, 6 qt………………	*Bacillus amyloliquefaciens*
Actinovate AG, 12 oz……………….	*Streptomyces lydicus*
Badge X2 DF, 0.75 lb……………….	Copper hydroxide + copper oxychloride
Basic Copper 53, 3 lb……………….	Basic copper sulfate
Taegro, 5.2 oz………………………	*Bacillus subtilis* var. *amyloliquefaciens*

Results: The results shown below are those from the trial that was carried out in 2013, when disease pressure was low. Nonetheless, Double Nickel 55 and Badge X2 DF treatments had significantly less black rot severity than the untreated control.

Treatment and Rate (/A)[x]	ALS Severity (%)[y]	BR Severity (%)[z]
Untreated Control......................	1.4 ab	3.1 b
Quadris, 15 fl oz........................	0.1 a	1.8 ab
Actigard 50WG, 1 oz..................	2.0 ab	1.5 ab
Serenade Optimum, 20 oz.............	1.0 ab	2.3 ab
Sonata, 4 qt.............................	1.0 ab	1.6 ab
Double Nickel 55, 6 qt.................	0.5 a	0.6 a
Actinovate AG, 12 oz..................	2.3 ab	1.5 ab
Badge X2 DF, 0.75 lb..................	2.5 ab	0.6 a
Basic Copper 53, 3 lb..................	4.8 b	1.6 ab
Taegro, 5.2 oz..........................	1.0 ab	1.4 ab
p-value	0.0233	0.0472

[x]Treatments were mixed with NuFilm at 1 pt/100 gallons and applied to foliage on 20 Aug, 30 Aug, 11 Sep, 23 Sep, 03 Oct.
[y]Precentage of foliage affected by Alternaria leaf spot at the final disease rating on 25 Oct. Numbers in each column followed by the same letter are not significantly different from each other (Tukey's HSD, P=0.05).
[z]Precentage of foliage affected by black rot at the final disease rating on 25 Oct. Numbers in each column followed by the same letter are not significantly different from each other (Tukey's HSD, P=0.05).

In 2014, fungicide applications will be made from August 1 to September 1, so data will be available later this fall. Disease severity and marketable yield data will be collected. Results will be published on the UMass Extension Vegetable Program website (http://extension.umass.edu/vegetable/), in the Vegetable Notes newsletter, and in Plant Disease Management Reports.

Symptoms of Alternaria leaf spot on cabbage.

Field trial setup.

Funding for this project was provided by the New England Vegetable & Berry Growers' Association, Bayer CropScience, and a grant from USDA NIFA.

NEV&BGA

Bayer CropScience

United States Department of Agriculture
National Institute of Food and Agriculture

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Evaluation of Conventional and OMRI-Approved Insecticides to Reduce Cabbage Root Maggot Damage

Block 9

Susan Scheufele, Katie Campbell-Nelson, Lisa McKeag, Ruth Hazzard

Rationale: Cabbage root maggot (*Delia radicum*) larvae feed on roots of brassica crops, causing substantial losses in spring plantings due to plant collapse. Feeding damage to fall root crops such as turnips and rutabagas renders them unmarketable. Chemical control options for conventional and organic growers are limited. A banded, soil drench of the organophosphate Lorsban (chlorpyriphos) at transplanting has been the commercial standard treatment for preventing root maggot infestation. Organophosphates have been the only chemical class of insecticide available and growers are seeking alternative chemistries for resistance management, and to reduce risk to applicators and the environment. We evaluated two new products in the diamide class, Coragen and Verimark, that offer greater flexibility in application method and timing, a long residual, and effective control of cabbage root maggot.

Additionally, we evaluated the OMRI-approved insecticide Entrust SC (spinosad) applied either as a transplant drench followed by soil drenches after transplanting, or just as soil drenches after transplant. Entrust is not currently labeled for cabbage root maggot or for transplant drench applications, so if effective, a label expansion would be pursued in order to make available a new tool in controlling cabbage root maggot on organic farms and a new rotational chemistry for conventional growers.

In a second trial we evaluated efficacy of new insecticide seed treatments in controlling cabbage root maggot and flea beetle in broccoli, compared to the current standard insecticide seed treatment, imidacloprid. Experimental seed coatings that we tested were composed of protective fungicides plus the neonicitinoid insecticide, thiamethoxam, at different rates and formulations. Seed treatments would offer an easier way to protect direct-seeded brassica crops such as radishes and fall crops like turnips and rutabagas from root maggot damage.

Research Goals:

- To demonstrate efficacy of new synthetic insecticides to reduce damage caused by cabbage root maggot and increase yields in spring brassica plantings.

- To evaluate efficacy of an OMRI-approved insecticide in reducing cabbage root maggot damage
- To pursue an expanded label for Entrust SC if that data supports its effective use.

Treatments:

Treatment	Active Ingredient	Rate/A	Application Method
Untreated	De-Ionized Water	na	Banded over row after transplant
Lorsban	Chlorpyrifos	2.4 floz	Banded over row after transplant
Verimark	Cyantraniliprole	13 fl oz	Tray drench in GH
Coragen	Chlorantraniliprole	5 fl oz	Tray drench in GH
Entrust SC-A	Spinosad	10 fl oz	Tray drench followed by banded at first adult flight; repeat foliar once 16 days later
Entrust SC-B	Spinsoad	10 fl oz	Banded at first flight; repeat foliar once 16 days after first application
Untreated	F300	na	Seed
FI400-C 0.05mg	FI400-C	0.05 mg/ seed	Seed
FI400-C 0.1mg	FI400-C	0.10 mg/ seed	Seed
FI400-EXP 0.05mg	FI400-EXP	0.05 mg/ seed	Seed
FI400-EXP 0.1mg	FI400-EXP	0.10 mg/ seed	Seed
Admire	Imidacloprid	AdmirePRO 7.0 fl oz	Banded over row at transplant

Results: Preliminary analysis of the data shows that, in the first trial, Verimark outperformed all treatments, including Lorsban, in plant vigor and yield. The Entrust treatment that included a tray drench and two field applications had significantly higher plant vigor and yield than the untreated control and performed as well as Lorsban in all measures. In the second trial, imidacloprid outperformed the seed treatment in measures of vigor and flea beetle damage. The 0.10 mg/seed rates performed better than the 0.05 mg/seed rates for both seed treatments, up to at least 18 days after transplant. By 25 days after transplant only the imidacloprid treated plants were more vigorous than the untreated control.

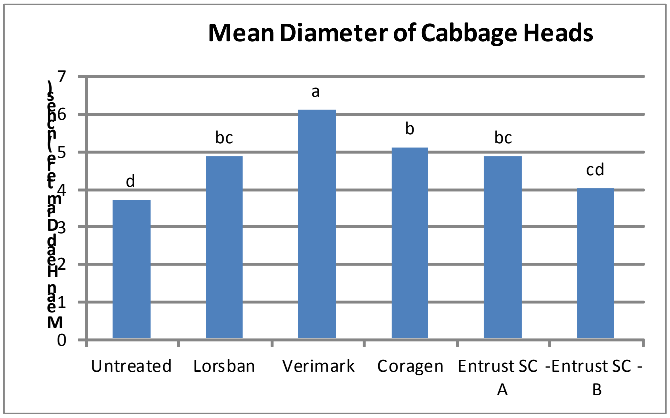

Figure 1. Yield data from Trial 1, cabbage drench treatments.

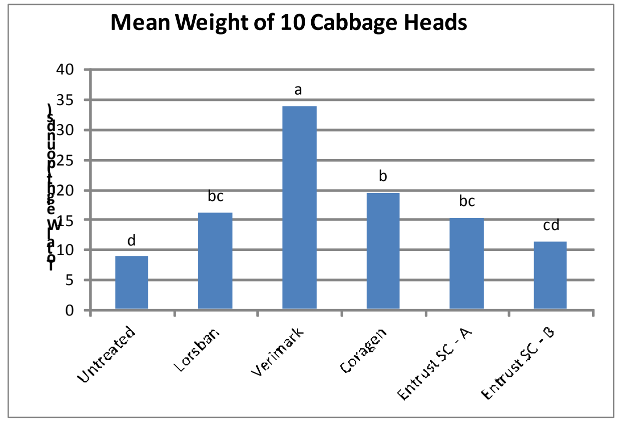

Figure 2. Yield data from Trial 1, cabbage drench treatments.

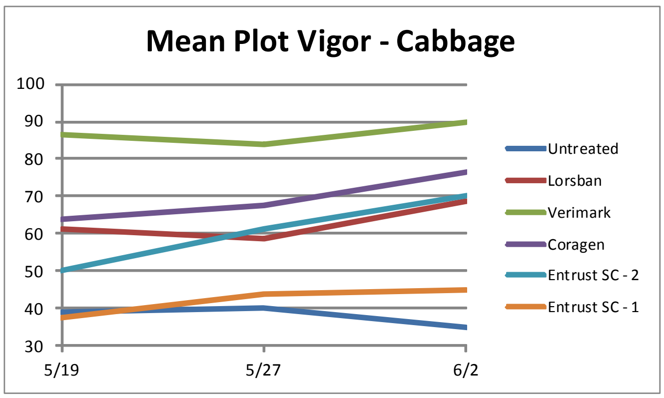

Figure 3. Vigor data from Trial 1, cabbage drench treatments.

	Mean Plot Vigor					
Treatment	5/19		5/27		6/2	
Untreated	38.8	c	40	c	35	c
Lorsban	61.3	b	58.8	bc	68.8	b
Verimark	86.3	a	83.8	a	90	a
Coragen	63.8	b	67.5	ba	76.3	ab
Entrust SC - 2	50	bc	61.3	bc	70	b
Entrust SC - 1	37.5	c	43.8	c	45	c
		$p < 0.0001$		$p = 0.0004$		$p < 0.0001$

Table 1. Vigor data from Trial 1, cabbage drench treatments.

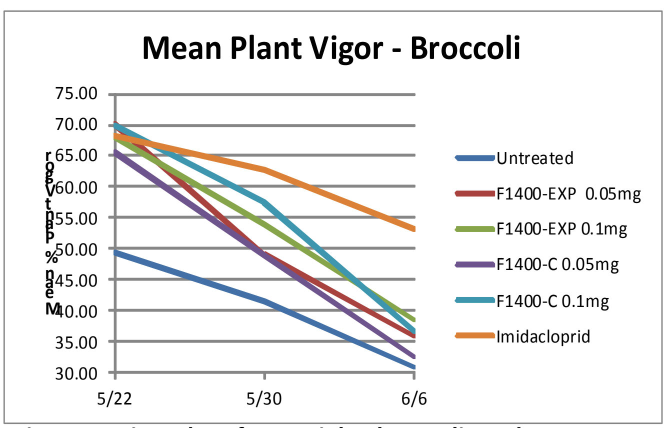

Figure 4. Vigor data from Trial 2, broccoli seed treatments.

	Mean Plant Vigor					
Treatment	5/22		5/30		6/6	
Untreated	49.25	b	41.38	c	30.88	b
F1400-EXP 0.05mg	70.13	a	49.13	bc	35.88	b
F1400-EXP 0.1mg	67.88	a	53.88	ab	38.50	b
F1400-C 0.05mg	65.63	a	48.88	bc	32.63	b
F1400-C 0.1mg	70.00	a	57.50	ab	36.63	b
Imidacloprid	68.13	a	62.75	a	53.13	a
		$p < 0.0001$		$p < 0.0001$		$p < 0.0001$

Table 2. Vigor data from Trial 2, broccoli seed treatments.

Funding for this project was provided by DuPont Crop Protection, Syngenta, the New England Vegetable & Berry Growers' Association, and a grant from USDA NIFA.

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United States Department of Agriculture
National Institute of Food and Agriculture

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Enhancing Soil Health with Hardwood Biochar

Block 7

Emily Cole, Stephen Herbert, Masoud Hashemi and Baoshan Xing

Rationale: The sustainability of small farms in the Northeastern U.S. has been continually threatened by both the rising costs to operate and the degradation of soil quality. Small farms compete with large farms for economic viability and without the large land area to increase profitability, they must find alternate ways to increase yield and/or decrease operating costs to stay profitable. One large factor involved in the sustainability and yield is the quality and health of the soils. Soil quality must be maintained to ensure high crop yield, yet often, conventional farming practices cause continual soil quality degradation from intensive cultivation and inorganic fertilizer application. Counteracting this inverse relationship is a major challenge and often requires significant shifts in agricultural management practices. Biochar has been touted as having many potential uses as a soil amendment including remediation of contaminated soils, carbon sequestration and specific soil characteristic alteration, such as increased cation exchange capacity, pH and nutrient availability. This project aims to investigate the influence of biochar on the soil's chemical, physical and biological properties as they relate to overall soil health and productivity.

Research Goals: The overall goal of this proposed work is to evaluate the addition of biochar as a soil amendment in a temperate agricultural field and in the greenhouse using live field soil. The specific objectives of this study are as follows:

(1) to study nutrient retention in soil amended by biochar; specifically to detect macro- and micronutrient status as a result of application of biochar to the soil.

(2) to quantify and analyze the nitrogen uptake and yield of sweet corn in biochar amended field soils.

(3) to characterize the effect of biochar on selected chemical and physical properties of the soil including pH, moisture retention and CEC.

(4) to observe soil biotic (bacteria and nematodes) community shifts due to application of biochar at field scale.

Treatments:

5 levels of biochar, 5 replicates, 25 total plots.

0% by weight, 0 Mg/Ha

2% by weight, 40 Mg/Ha

4% by weight, 80 Mg/Ha

6% by weight, 120 Mg/Ha

8% by weight, 160 Mg/Ha

Results: While no significant differences in yield have been seen thus far; there have been significant changes in the soil properties. Besides the increased pH and CEC, large increases in retained cationic nutrients such as Mg, Ca, K and Mn.

Initial Sample &	*Density*	*Soil*	*CEC*
July 2012	***0.92***	***5.6***	***8.4***
July 2013, 0%	*0.89*	*6.2*	*9.3*
2%	*0.84*	*6.6*	*9.1*
4%	*0.84*	*6.9*	*9.2*
6%	*0.79*	*7.1*	*9.6*
8%	*0.83*	*7.1*	*9.7*

Biochar application, July 2012

Sweet corn rows, July 2014

The Center *for* Agriculture, Food and the Environment

For more information please contact Emily Cole via email at ejcole@umass.edu.

Improving Soil Fertility with Rock Dust Blends and Biochar

Block 14

Kate Gervais, Stephen Herbert

Rationale: Soil fertility directly impacts the yield and nutrient density of the plants grown within it. Plants remove water and nutrients from the soil as they are used. Conventional fertilizers applied to replace these nutrients often contain only a handful of elements that are the most used in plant growth. With time, this results in deficits of the nutrients that are not replenished in some way, which translates into less nutritious food. Use of ground rock dust blends as a soil amendment may provide a more complete source of many plant-available elements and minerals, allowing for more wholesome plant growth and the production of higher quality, more nutrient-dense foods. The mechanism by which the rock dust is broken down also provides long-term improvements to soil fertility, reducing the resources needed to apply the amendment, thereby improving the overall sustainability of the growing operation.

Additionally, biochar has been promoted as a sustainable soil amendment able to further improve overall soil quality by stabilizing the pH, increasing cation exchange capacity, acting as a nutrient-sink to minimize issues with leaching and contamination, keeping nutrients where they are physically available to the plant, and locally improving soil texture and water retention.

Both rock dust and biochar offer sustainable uses for by-products of other industries, such as forestry and drilling/mining. They may eventually offer affordable, long-term soil improvement for farming operations wishing to engage in environmentally friendly or sustainable agricultural practices.

Research Goals: The goal of this study is to examine the efficacy of applying a locally-mined basalt rock dust blend and biochar as soil amendments - their effects on overall soil health and function, and plant yield and nutrient density within a single growing season. This study examines the growth of La Roma tomatoes, and Aruba sweet peppers, both grown as conventional crops in the Pioneer Valley.

Treatments: Four levels of rock dust, two levels of biochar, four replicates, thirty-two total plots:

Ro

Bio ec

Plo ar

Rock dust applied on fields

Tomatoes and peppers, July 2014

For more information please contact Kate Gervais at katemarie.gervais@gmail.com, or Stephen Herbert at sherbert@cns.umass.edu.

Nitrogen contribution of fava beans to following cash crop

Block 4

Fatemeh Etemadi, Masoud Hashemi

Rationale: Fava beans are a cool season legume crop with high nutrition values and have the potential to replace imports of soybean meal to Northeastern United States. Fava beans can be grown after harvesting a spring planted cash crop and be used as cover crop. In addition to the potential of introducing a new cash crop to growers in the Northeastern U.S., fava beans as a legume have the ability to fix atmospheric nitrogen and therefore reduce the cost of nitrogen fertilizer. It has been reported that fava beans can fix up to 120 pounds of nitrogen per acre when complete crop is incorporated into soil.

As cover crop, fava beans can significantly stimulate microbial activity and thereby enhance natural soil fertility, improve soil structure and water-holding capacity, and thus improve the yield potential of crops when compared to continuous cropping system which relies on N-fertilizers.

The duration of time between fava bean harvest and sowing the next crop, the turnover rate of above and below-ground legume N in soil, the timing of the requirement for N by the subsequent crop in relation to the supply of plant-available forms of N, and the prevailing climatic conditions are all factors that will influence the efficiency at which N derived from legume residues will either be utilized for the growth of a following crop, or be lost from the plant–soil system. Leaving legume residues as mulch rather than soil incorporation ensures a slower release of plant nutrients and may improve the synchrony of nutrient release with subsequent crop requirements.

Research Goals:

- Assessing nitrogen contribution from fava beans to sweet corn
- Determining decomposition rate of fava bean residues

Treatments:

3 dates of planting of fava beans: August/01/2013, August/07/2013, and August/14/2013

5 rates of Nitrogen application to sweet corn: 0, 25, 50, 75, 100 lbs N/ac4 Replications

Thank you to our sponsor:

Floral traits affecting disease transmission in bumble bees

Block 16

Project managers: Melissa Ha, Nelson Milano

Research assistants: Dana Delaney, Olivia Biller, Ian Weston, Jonathan Giacomini, Devin Shaheen, Sam Fogel, Ali Hogeboom

Independent research undergraduates: Patrick Anderson, Sara Connon, Taylor Conroy

Rationale: Bees provide pollination services that are essential for plant conservation and crop production worth billions of dollars annually in the U.S. Although honey bees are the most well-known pollinators, native bees are also important, particularly when honey bees are absent. Declines in both honey bees and native bees have been reported recently. While the combination of many factors is responsible for these population changes, diseases are one of the major components.

Natural chemical defenses may occur in all plant parts and can be toxic to or deter animals that eat plants (herbivores). Interestingly, some herbivores have co-opted these compounds as a means of decreasing parasitism and predation. Bees are herbivores that have specialized on plant nectar and pollen, plant tissues which can contain plant chemical defenses. Thus, both honey and native bees are frequently exposed to plant chemical defenses, but the role of such chemicals for bee health and disease is almost unknown. One published study and pilot data indicate that many floral chemicals can reduce disease, suggesting that this research may provide new mechanisms for managing bee diseases and combating pollinator decline.

Research Goals: This research will examine the impact of plant chemical defenses on bee health and disease loads using bumble bees, honey bees, and their common diseases. The research has three main objectives: (1) Pollen, nectar and floral tissue will be surveyed from abundant wild plant and crop species from the northeastern U.S. to assess the extent to which bees are naturally exposed to plant chemicals in their diet. (2) Laboratory experiments will determine whether specific floral compounds reduce or exacerbate bee disease, and how both chemicals and diseases affect bee health. (3) Laboratory and field experiments will assess the role of plant defensive chemicals and other floral traits on disease transmission between flowers and bees. Taken together, this research represents a novel approach that provides empirical insight into the diversity of roles that plant defensive chemicals can play in food webs, while addressing the contemporary societal issue of bee health and disease.

Treatments: This summer, our field plot will determine whether disease transmission dynamics in bumble bees differ across plant species, and elucidate whether floral traits and/or pollinator attraction influence disease transmission. This is an observational study, in which we are comparing transmission of a common bumble bee disease across 15 plant species for which we also have chemical and floral trait data.

Results We do not yet have results from this study. Our goal is to have most of the plants flowering in July and August, when disease levels in wild bees are highest.

Thank you to our sponsors:

United States Department of Agriculture
National Institute of Food and Agriculture

For more information please contact Lynn Adler via email at: lsadler@ent.umass.edu

Mustard as a biofumigant cover crop

Block 16

Katie Campbell-Nelson, Susan Scheufele, Lisa Mckeag, Ruth Hazzard and Neal Woodard

Rationale: "Caliente" mustard (*Brassica juncea)* produces the biofumigant compound allyl-isothiocyanate when the plant cells are broken as it is incorporated into the soil and decomposes. Biofumigation is being adopted as a method for managing nematodes and soil-borne pathogens such as *Pythium, Rhizoctonia* and *Phytophthora capsici*. This cover crop has been grown successfully by several Massachusetts farmers as a spring cover crop prior to seeding fall squash and pumpkins, or it has been used as a short season summer cover crop in a fallow field to prepare an area for the following year's crop such as strawberries.

Research Goals: We hope to gain experience growing this cover crop and maximize its effect as a biofumigant while sharing the information with interested growers. Because *Phytophthora* blight is a big concern of MA vegetable growers, we chose to study the effects of Caliente mustard cover crop on suppressing *P. capsici* incidence. Fungicide treatments alone are not sufficient for managing this disease and cultural practices are also needed. By growing Caliente mustard and Oat cover crops side by side in a field, we are able to compare the effects of a biofumigant cover crop with a non-fumigant cover crop in suppressing *P. capsici*. To conduct this comparison without inoculating fields with this pathogen and causing long term damage, we are conducting greenhouse bio-assays to test the effect of the fumigant on a susceptible host (pepper) in biofumigated and non-fumigated soil from the same field.

Treatments: Seeding: (4/28/14) 50 lbs nitrogen/acre in the form of urea and 20 lbs sulfur/acre in the form of gypsum were applied prior to planting. We used a no-till grain drill to seed Caliente mustard at a rate of 9 to 12 lb./A, ¼–¾ in. deep, in rows 6-8 inches apart and Oats at a rate of 110 lb./A, 1/2-1inch deep, in rows 6-8 inches apart. **Germination was observed on 5/1/14.**

Chopping and incorporating: (6/24/14). Caliente and Oats were allowed to grow until the Caliente was at maximum flowering (about 50-60 days). We flail chopped the field with a rotary mower and immediately incorporated the residue with a chisel plow. Next, we followed the plow with a disc. Finally, we drove over the field with a heavy roller or culti-packer to seal in the volatile compounds as the broken cells released allyl-isothiocyanate.

Greenhouse bioassay (6/26/14 – 7/14/14): The fumigation process is reported to last 0-7 days, so we sampled soil from caliente and oat plots to conduct a greenhouse bioassay 2 days after incorporation. Five pepper plants were potted into each of 4 replicates, and we inoculated treated pots with the mycelium and sporangia of local *P. capsici* isolates cultured at the UMass Diagnostic Lab. **Treatments are as follows:** Caliente soil not inoculated, Oat soil not inoculated, Sterile field soil not inoculated, Caliente soil inoculated, Oat soil inoculated, and Sterile field soil inoculated. Each pot was rated daily for incidence of *Phytophthora* blight out of 5 potted peppers.

Results: Seeding mustard with a no-till grain drill was not effective because the seed is very light and we did not get very good soil to seed contact; many of the seeds germinated on the soil surface. Broadcasting and discing in the seed or using a cone-seeder may be preferable. Preliminary results from the bioassay indicate that *P. capsici* inoculated soil with Caliente mustard as a biofumigant developed symptoms more slowly than Oat or Sterile field soil, and were not as severe (Figure 1). Differences in vigor (including canopy thickness, and color) were also observed among treatments (Figure 2). The results of this bioassay indicate that a trial is necessary in field conditions where *P. capsici* is present.

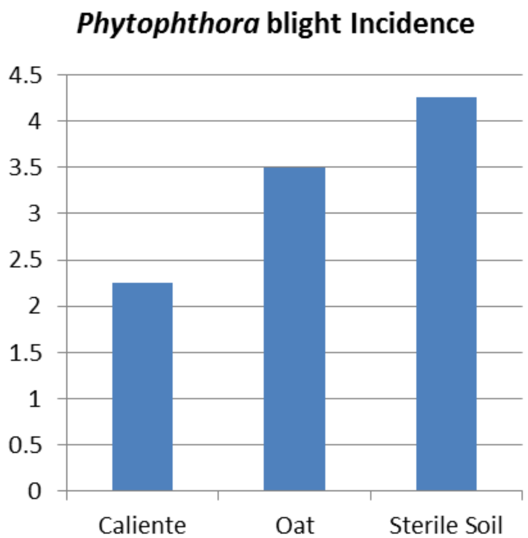

Fig. 1 Average incidence of P*hytophthora* blight out of 5 pepper plants in pots inoculated with *P. capsici* on 6/27/14 and rated on 7/9/14.

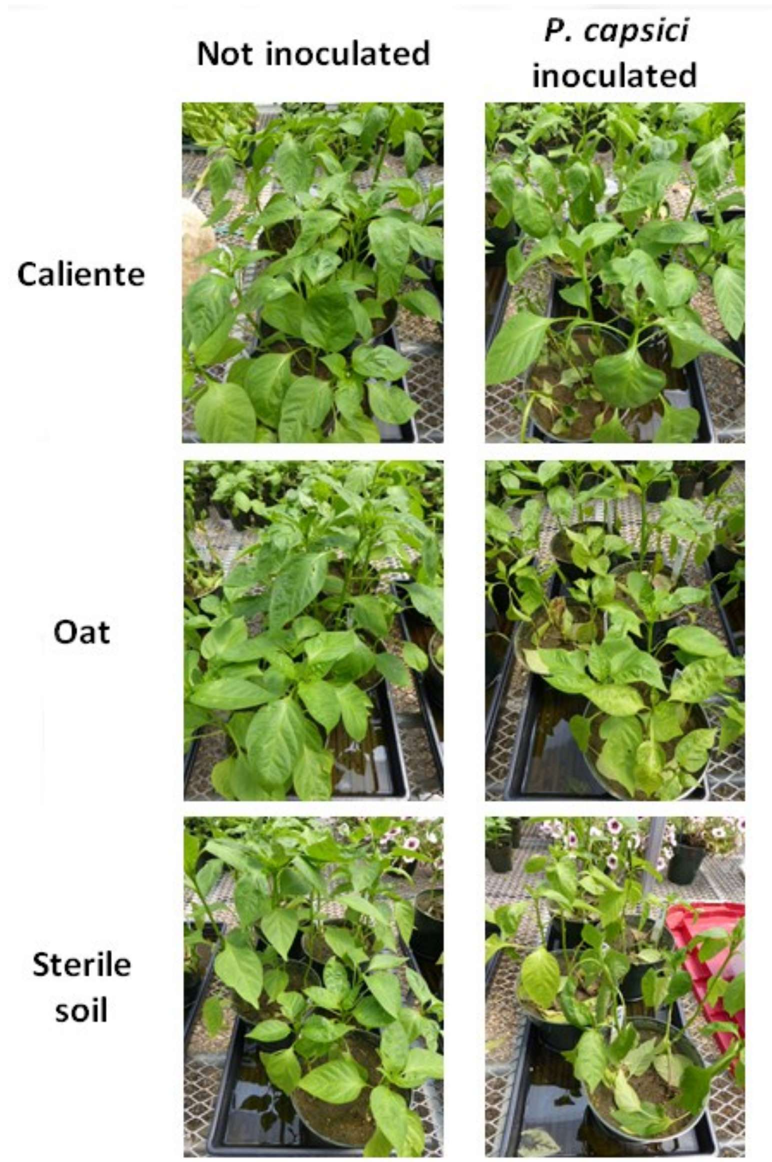

Fig. 2 Differences in vigor including canopy coverage and plant color were observed among treatments.

Funding for this project was provided by a grant from USDA NIFA.

USDA NIFA

United States Department of Agriculture
National Institute of Food and Agriculture

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Evaluation of Selections of jiló (*Solanun gilo*) for Production and Markets in the Northeastern United States

Block 17

Aline Marchese, Frank Mangan, Zoraia Barros and Viviane Barros

Rationale: Jiló (*Solanum gilo*) is a type of eggplant in Solanaceous family which has smaller fruit than most *S. melongena* eggplant types and it is bitter to taste. Fruit color varies, with shades of green and white the most common when immature and shades of red and orange when mature. The fruit shape can be round or oblong. It is an important vegetable in Southwest of Brazil and West Africa.

Their use has been limited to ethnic markets, especially in regions where there are large populations of Brazilian and African immigrants, including the states of Massachusetts, New Jersey and New York. Due to the strong demand by immigrants for jiló, local farmers have found this to be a viable crop. So long as not produced in excess of demand. One issue farmers face in Massachusetts is a relatively short growing season compared to other regions of the US. One way to address this issue is to grow varieties of vegetables that have earlier yields in order to extend the season. This research is evaluating hybrid varieties of jiló, developed at the Universidade Federal de Lavras, a University in Brazil, for their adaptation to the Massachusetts' climate.

The University of Massachusetts (UMass) has taken a leadership role in research to take advantage of the growing ethnic diversity present in the state and region. This research is not just conducted to investigate the cultural requirements, but also the market acceptability and demand for these hybrid varieties.

Research Goals: The goals of this study are to increase the productivity and enhance early yield of jiló for U.S. producers through the analysis and selection for adaptation of superior cultivars.

Treatments: Twelve varieties of jiló (*Solanum gilo*) are being evaluated:

Ten hybrid cultivars from the Vegetable Breeding Program at Universidade Federal de Lavras, Brazil;

Cultivar "Comprido Verde Claro", obtained from a commercial farm in Massachusetts;

and a white variety (Garden Egg), obtained from Chacara Paraiso, a commercial Farm in Brazil.

Results: Table 1 shows the genotype responses for flowering and plant height.

Table 1: Plant height at first flowering and number of days after transplant to flowering in 10 experimental hybrids and two cultivars of jiló. Deerfield, MA, US. July 1st, 2014.

Genotypes	**Plant height** (inches)		**Flowering** (days after transplant)	
Exp. Hybrid 1	9.90	b	33.8	B
Exp. Hybrid 2	7.74	c	34.1	B
Exp. Hybrid 3	7.75	c	34.6	B
Exp. Hybrid 4	10.67	a	34.4	B
Exp. Hybrid 5	9.77	b	34.1	B
Exp. Hybrid 6	8.95	b	32.5	B
Exp. Hybrid 7	6.95	c	34.6	B
Exp. Hybrid 8	8.87	b	33.7	B
Exp. Hybrid 9	9.62	b	32.8	B
Exp. Hybrid 10	8.95	b	33.8	B
Garden Egg	10.67	a	37.3	A
Comprido Verde Claro	5.86	d	36.3	A

** Different letters in columns indicate statistical difference between treatments at 5% significance level according to Scott-Knott test.*

Plant height was different between genotypes, showing genetic diversity among them. Comprido Verde Claro, the cultivar that farmers have been using in Massachusetts, showed the slowest vegetative development. This result indicates that cultivars with faster development can be selected to increase the jiló yield in our region.

Picture 1: Comparison of growth between Comprido Verde Claro and Experimental Hybrid 4 at the same vegetative stage. Photo taken on July, 1st 2014.

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