Michigan State University

Upper Peninsula Research and Extension Center

Center Report July 2015

Michigan State University AgBioResearch

MICHIGAN STATE UNIVERSITY | Extension

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Center Report 2015

History of Michigan State University Research in Chatham, Michigan

Established in 1899

Excerpt taken from a report by Daniel J. Hunt (Station Superintendent at the time) written in 1974 to current U.P. County Extension Directors

> "It started back in 1899 when Michigan's legislature, recognizing that soil and climate in the Upper Peninsula were different than in most of the rest of Michigan, decided this area needed some special study. The appropriated $5,000 for the State Board of Agriculture (this board is now called the Board of Trustees, Michigan State University) to 'carry on such experiments pertaining to agriculture and horticulture as, in their judgment, will be most beneficial to the agricultural interests of the Upper Peninsula.' For the first time, the Michigan Agricultural Experiment Station had an opportunity to conduct research work under the special weather and soil conditions in this area.
>
> After making extensive surveys, the State Board of Agriculture decided to accept from the Munising Railroad Company (now the Lake Superior and Ishpeming) a donation of 160 acres of land north of the village of Chatham. The railroad company also agreed to 'stump, clear, and grub; at least 20 acres so that immediate field demonstration work could begin. So started the Upper Peninsula Experiment Station at Chatham.
>
> Ten years later the Cleveland Cliffs Iron Company gave Michigan State University 620 acres adjacent to the village of Chatham. Since the timber had been removed, considerably more land was made available for experiments. It provided enough acres of cropland to start much-needed crops and livestock experiments. Previously, the Experiment Station had been a demonstration farm because there had not been enough land available to conduct satisfactory field experiments.
>
> Several smaller tracts of land have been acquired since then until now the Station proper in Chatham contains 830 acres, approximately 250 which are being tilled. In addition, the Jim Wells Forest of 440 acres is located eight miles north of the main station.
>
> The Station is and has been devoted to securing information that will improve agricultural management and thus provide more income and higher living standard for the people in the Upper Peninsula."

Historical records of what was initially called the Chatham Sub-Station, show a very diverse research and demonstration portfolio. In addition to the beef cattle and agronomy research that continues at the farm today, forestry, poultry (ended 1966), horses, sheep, and hogs (all ending in 1948), made for a very robust farm. Horticultural plots were also a mainstay at the farm, in addition to potatoes and cereal grains.

Station expanded in 1984

The Station received its first herd of dairy cattle in 1912, and throughout the Station's history, dairy research has been a prominent feature at the Farm. In order to modernize the milking facility, a new operation was established at what is now known as the main farm site south of Chatham. These facilities, built throughout the mid-1980s included a tie-stall barn, a freestall barn, new shop/equipment shed, office, and living quarters for the Farm Manager. Dairy research continued at the farm until the herd was sold in 2012.

Station undergoes restructuring

Statewide budget cuts throughout the University system, prompted an assessment of all outlying research facilities, now under the management of MSU AgBioResearch, for productivity and fiscal soundness. Due to the remote nature of the Station, it was becoming more difficult to recruit and retain researcher interest from campus to ensure a robust research portfolio. These concerns prompted the formation of a restructuring committee comprised of stakeholders from throughout the state. Their task was to identify challenges to the Station and propose a new direction for research.

The committee identified the need to hire a coordinator to oversee the research and Extension objectives. This individual was to work in close collaboration with Upper Peninsula stakeholders and MSU campus faculty. In addition, three campus-based faculty were assigned as faculty coordinators with direction to engage in research at the farm. Finally, the facility was renamed the Upper Peninsula Research and Extension Center, placing emphasis on the importance that Extension would play into the future.

> "The Station has appreciated the part that tractors and trucks are doing in modern agriculture, but believes that the horse is more suitable for much of the work on Upper Peninsula farms."
> *The Michigan Agriculturist*
> January 1931

Upper Peninsula Research and Extension Center

Purpose

The Upper Peninsula Research and Extension Center (UPREC) was established in 1899 and serves as the hub for integrated crop and livestock research for Michigan's Upper Peninsula. Applied research on pasture-based cattle management practices and cropping rotations is conducted in the unique environment of the U.P. Grass-based beef finishing, utilization of cover crops, hoophouse farming, season extension and soil health studies are keystone research elements on the farm. Outreach efforts focus on expanding knowledge of local food systems by educating producers and fostering market opportunities. Complementary agronomic studies at the 1,262-acre site focus on forages and small grains. The center also coordinates field trials on potato varieties and corn varieties throughout the Upper Peninsula region.

Research Goals

1. Improvement of soil quality to enhance the productivity of U.P. agricultural lands in a manner that emphasizes health linkages associated with soil, crop, livestock and people.
2. Development of research that demonstrates the costs and benefits of integrated crop livestock systems, including grass-based livestock production. Closer collaboration between UPREC and Lake City Research Center (LCRC) in Lake City to foster complementary research endeavors and to increase the quality and quantity of research results.
3. Development of research tied to the educational needs of regional food systems in the Upper Peninsula that contributes to community sustainability while linking to objectives 1 and 2.



Upper Peninsula Research and Extension Center Staff and Resource Personnel

Ashley McFarland
Center Coordinator

Paul Naasz
Farm Manager

Collin Thompson
North Farm Manager

Christian Kapp
Research Assistant

Michelle Coleman
Secretary

Joe Charlebois
Agriculture and Special Equipment Operator

Floyd Kienitz
Ag Laborer

Darin Tyner
Ag Laborer

Faculty Coordinators
Dr. Kim Cassida – Academic Specialist – Department of Plant, Soil and Microbial Sciences

Dr. Matt R. Raven – Professor – Department of Community Sustainability

Dr. Jason Rowntree – Associate Professor – Department of Animal Science

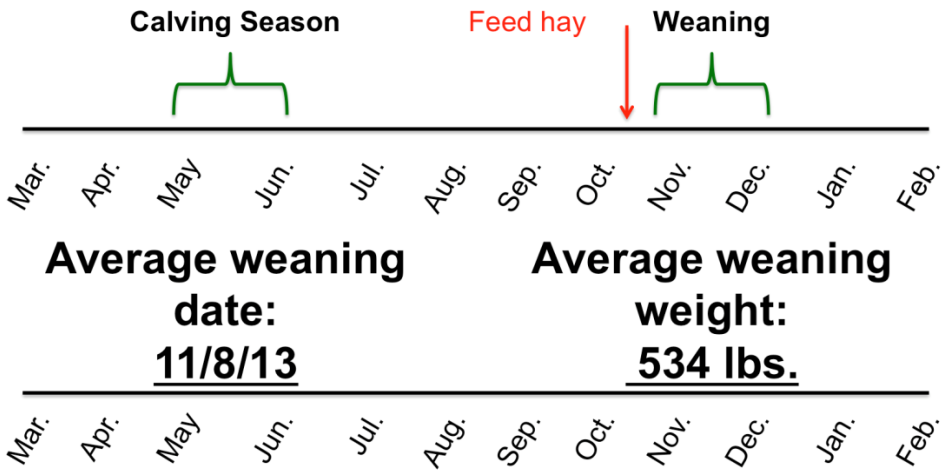
Grass-fed and cow-calf beef performance at the Upper Peninsula Research and Extension Center

Jason Rowntree, Paul Naasz, Kim Cassida and Rachel Martin

The 2013-14 production years mark the first entire cycle of production for the beef program at UPREC. In winter of 2012, 80 Red Angus females were transported from Lake City Research Center to the Upper Peninsula. The purpose of the transfer was to not only provide consistency and mutual use across both research centers, but to also begin more in-depth investigation of pasture-based production systems. The history of the Red Angus herd links back to 5L Red Angus, Sheridan, MT. The 5L herd is the largest register of Red Angus cattle nationally at around 1800 cows annually. Michigan State University was fortunate to purchase 10% of the cowherd to begin new programming. Importantly, the purchased genetic base has been known for their ease of flesh and ability to marble on forage, traits sought after for our research project.

In 2013, the 80 cows calved for the first time and 76 calves were weaned from the first calf-crop. The average day of calving was 5/13/13 and the average weaning weight on 11/8/2013 (not adjusted) was 534 lbs (Figure 1). For the first winter, calves were backgrounded on alfalfa-centric baleage put up around 45% dry matter. The calves were placed back onto pasture 5/20/14 at a mean weight of 703 pounds.

Figure 1. Calving and Weaning Cycle for the UPREC Cowherd



Yearling cattle were grazed without supplementation until 10/16/14 until they were supplemented baleage while continuing to graze. They were removed from pasture on 11/4/14 with an average weight of 1067 lbs. Cattle were continually offered baleage free choice until they were finished (Figure 2). The mean finish day of the cattle was January 2015 with an average weight of 1171 pounds.

Figure 2. Steer Performance throughout the Finishing Period

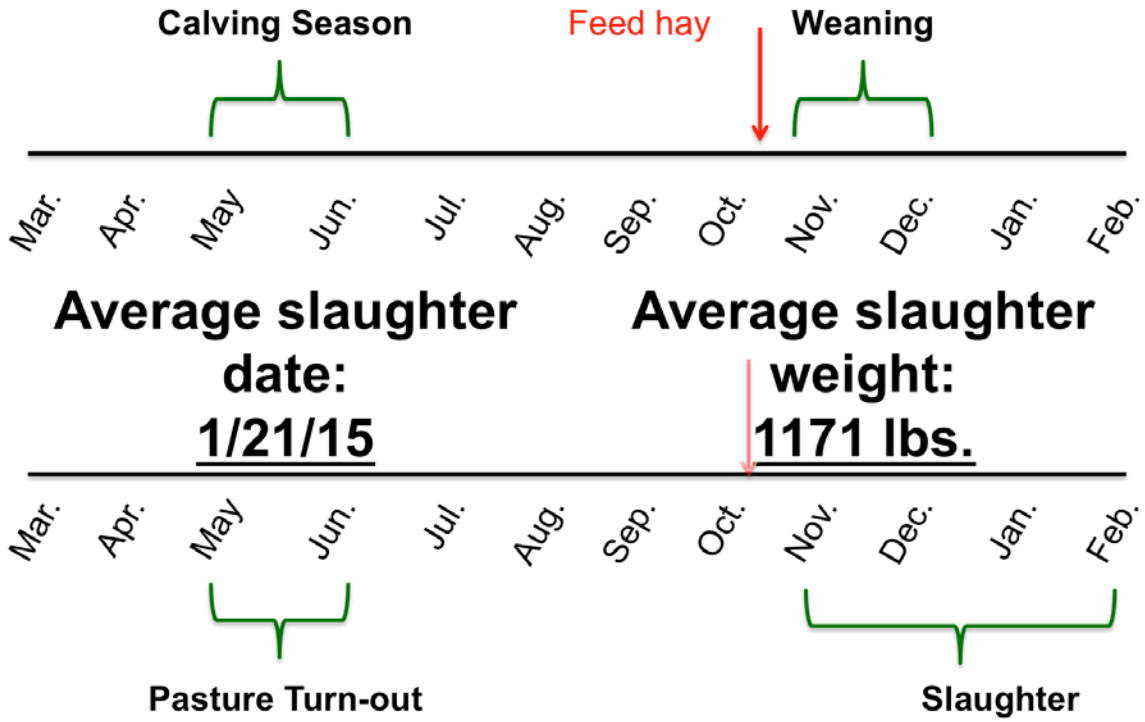


Figure 3. Overall Weight Gain and Carcass Merit

- **Age at sale**
  - 605 days
- **Live Weight @ sale**
  - 1171 lbs.
- **Weight per day of age**
  - 1.85 lbs./day
- **Hip Height**
  - 51 ¼ inches
- **Hot Carcass Weight**
  - 662 lbs.
- **Dressing Percent**
  - 56.5%
- **Backfat**
  - 0.18 inches
- **Ribeye Area**
  - 11.5 inches^2
- **Marbling Score**
  - 420 (select)

Cattle had an overall weight per day of age of 1.85 and 51.25 inch hip height, resulting in a high 3 to low 4 frame score. They were slaughtered, on average at 21 mo. Average carcass weight was 662 lbs with an average dressing percent of 56.5 %, 11.5 in ribeye and 420 or low Select marbling score. The steers were sold for $3.00/lb on a carcass weight basis.

From a feed perspective, we calculate the cattle were fed 1.34 tons of hay (DM) during the growing period through the first winter and then offered an additional 1.15 tons during the final period resulting in 2.49 tons of feed offered overall.

Moving forward, there is certainly room for improvement in the production model. First, due to the winters of the UP and the moisture in the baleage (vs dry hay), it is more challenging to get weight on the steers through the backgrounding period. While our shelter is adequate, there is a high maintenance requirement. Without question, neutral detergent fiber (NDF) forage below 45 is required to put weight on the cattle during the winter. Ideally, the hay should be dry, but ultimately with the overall humid conditions of the UP, putting up high quality dry hay is very challenging.

Secondly, we want to increase the overall backfat and marbling of the cattle. Ultimately the challenge is carrying the cattle into the second winter. Maintenance requirements begin to rise ultimately making it very difficult to see cattle with appreciating weight gain in December and January. This is turn stagnates growth just before the endpoint and perhaps the cattle can even go backwards during this timeframe.

In order to address these issues, UPREC Beef manager, Paul Naasz and faculty have collectively decided to begin a fall calving program at UPREC. Our hope is that cattle can be adequately finished into the 22-24 month period on lush standing forage resulting in less overall high quality hay needing to be fed.

Finally, our extension staff would like to invite you to attend the 2015 Grassfed Exchange September 16-18 to be held in Mt. Pleasant MI. This is an outstanding educational opportunity that brings the nation's best grazers and grass-finishers together. The first day will be tours of Grahams Organics and Lake City Research Center followed by two days of speakers and networking.

Integrated Cropping and Livestock Systems Trial Examining Soil Health

Kim Cassida, Chris Long, Jason Rowntree, Matt R. Raven, Lisa Tiemann, Noah Rosenzweig, Christian Kapp, Paul Naasz, and Ashley McFarland

Research Overview

This project focuses on using the systemic integration of crops and livestock in farming systems for the Upper Peninsula. This may seem like an old topic, but in reality modern agriculture increasingly separates crop and animal production into completely separate enterprises , resulting in unexpected negative consequences to soil health, resource conservation, profitability, and food security. We seek to show how integration may be able to reverse these consequences.

Our project has four farming system treatments: 1) T1, all row crops in a four-year rotation, 2) T2, one year of grazing followed by three years of row crops, 3) T3, three years of grazing followed by one year of row crop, and 4) T4, permanent pasture. These treatments establish a range of livestock presence from never (T1) to always (T4). The project is planned as long-term research with a flexible crop rotation that will adjust to changing knowledge and markets. Proposed rotations are illustrated in Table 1. Each treatment is established in four replications of 4-acre "farmlets," for a total trial acreage of 64 acres. Two of the main treatments are split into sub-experiments. T1 is split by tillage (conventional or

no-till) and cover crop (cover crops, no cover crops) treatments. T3 is split by row crop treatment (malt barley, or potatoes). Basic management premises for the trial include: 1) using no-till for all planting operations except potatoes and the conventional tillage sub-experiment, 2) managing cattle under grass-fed regulations, 3) using cattle as land management tools for fertility and weed control as much as possible within T2, T3, and T4,and 4) minimizing purchased inputs as much as possible.

Results

The trial began in 2013 with establishment of an 11-species cover crop mixture over the entire 64 acres. The cover crop, intended to help equalize legacy effects of the previous cropping history, was mob-grazed once by the cow herd in late summer/fall. In 2014, soil samples were collected across the entire 64 acres before any individual treatments were initiated. The purpose of these samples is to provide baseline data on the state of the soils before any treatments were applied, and they have been archived for use by researchers as needed in the future.

The T1 treatment was planted to a forage crop of spring oats and peas in 2014, which was made into baleage yielding approximately 3.1 tons DM/acre. There was no difference between tillage and no-till treatments for species distribution in the harvested baleage consisting of 41% peas, 20% oats, and 39% weeds. Much of the "weed" biomass consisted of volunteer cover crop species that reseeded from 2013, primarily proso millet. This year, T1 is planted to silage corn.

The T2 farmlets were planted to an annual forage mixture (field peas, crimson clover, oats, and forage collards) in 2014. Each 4-acre farmlet was mob-grazed once with 16 cow-calf units in August 2014. Average pre-graze forage availability was 2.63 ton DM/acre and cattle consumed 40% of it. The remaining forage was left as ground residue totaling 1.44 tons DM/acre, with any surviving plants killed with glyphosate prior to winter wheat planting. In theory, leaving such large amounts of residue will help build soil organic matter, but in practice this proved to be too much residue for effective no-till wheat planting, and wheat establishment failed. The T2 farmlets were replanted to spring oats in spring 2015 because oats were judged to have the most profit potential of the available emergency planting options.

The permanent pasture rotations for T3 and T4 were established in spring 2014 as a cool-season perennial mixture of 'Tekapo' orchardgrass, 'Barolex' tall fescue, 'Ameristand403T' alfalfa, 'Kopu II' white clover, and 'Bruce' birdsfoot trefoil. The mixture was planted at 15 lb/acre, resulting in each component being planted at 1/5 of its recommended monoculture planting rate. The seeding was slow to establish, partly due to high "weed" pressure from volunteer cover crops, and pastures were not grazed in 2014. One cutting of greenchop was removed in July 2014, at which time total dry forage biomass averaged 1.81 tons/acre across both treatments. Two out of the eight farmlets failed to establish acceptable perennial stands and are being partly reseeded in 2015. In May 2015, we began grazing T3 and T4 with grass-fed finishing steers under a management intensive grazing (MiG) system. Forage biomass is estimated pre- and post-grazing using a rising plate meter (RPM). The RPM tool relates the amount of forage to the height of a weighted plate above the ground and is a fast, non-destructive way to estimate available forage. In addition, weekly RPM estimates of forage biomass in every paddock allow construction of a tool called a grazing wedge (Figure 1). The grazing wedge tool allows prediction of forage growth rates. The wedge shows standing biomass in every paddock, ranked

by the number of days since they were last grazed. The slope of the line represents the rate of forage growth in pounds of dry matter per day. This tool also allows fast identification of paddocks that are not growing as well as others, so that remedial action can be taken if needed.

We added the potato rotation treatment to T3 in 2015 as part of a pilot project to investigate the effect of forage crop rotations on potato pathogens. Lack of irrigation at UPREC is an issue for expansion of our potato research, but to date the potato plots are doing well under dryland conditions. If the dryland test plots do well in 2015, the potato aspect may be scaled up in future years.

The research plan includes monitoring of soil microbial populations and pathogens as indicators of soil health across all treatments. Annual soil testing in the fall will track soil fertility changes related to use of livestock and cover crops. Soil samples will be collected across all treatments in 2015 to map microbial and pathogen populations. Changes in soil carbon sequestration and nitrogen will be monitored every few years and compared to the background levels measured in 2014.

Research Outlook

The future of this project depends on securing long-term federal funding. The first two years of work have been funded by seed money from Project GREEEN to assist with collecting preliminary data to support a larger proposal. The nature of crop rotation research means that it will take several years before we have collected enough data to make sweeping recommendation.

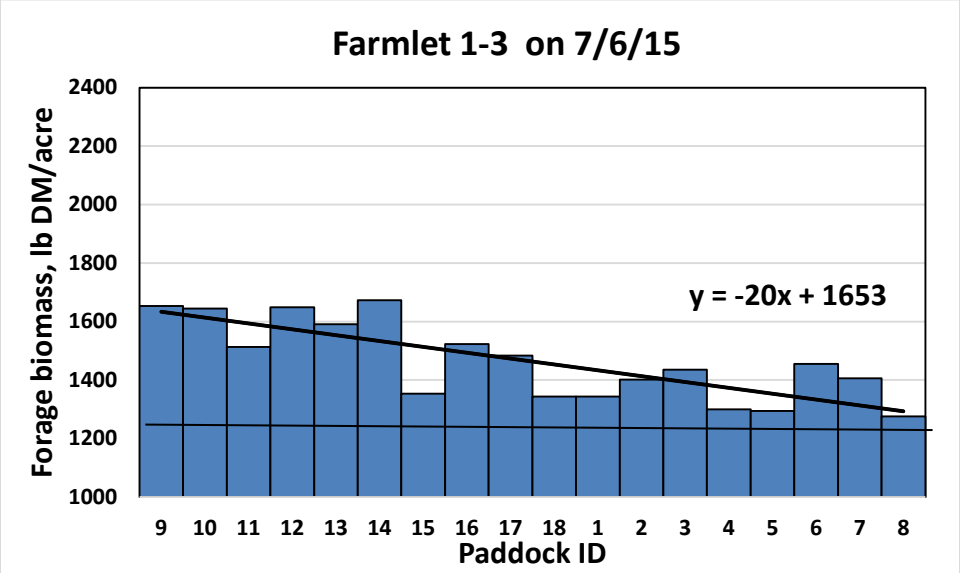


Figure 1. The grazing wedge provides much useful information. If cattle are moving every day, then paddock #8 is the one cattle are in (0 days rest) and paddock #9, been rested for 17 days, is the one they are about to move into. The horizontal line at 1200 lb/acre represents forage biomass we never want to go below in order to insure adequate residual to support regrowth. We would prefer to have 2400 lb/acre (top edge) in the new paddock. This set of paddocks is only growing 20 lb of forage DM per day of rest (the inverse slope of the regression line), so it is impossible to reach our entry biomass target in only 17 days of rest. We need to slow down the rotation to give the grass more time to recover.

Table 1. Crop rotation treatments and proposed cropping sequence.

	Treatment 1	Treatment 2	Treatment 3	Treatment 4
crop rotation	4 yr row crop, no pasture	3 yr row crop, 1 yr pasture	1 yr row crop, 3 yr pasture	No row crop, 4 yr pasture
tillage	Split: Conventional or no-till	no-till	no-till	no-till
cover crop	Split: Yes or no	yes	yes	yes
livestock	no	yes	yes	yes
	Year 1 (2014) (funded by Project GREEEN Seed project)			
Crop	Peas & Oat silage	Annual pasture mix	Perennial pasture mix	Perennial pasture mix
Planting date	Mid May	Early May	Early May	Early May
Harvest date	Early July	Grazing 2-4x	Grazing 3-5x	Grazing 3-5x
Post-harvest management	Fallow	Terminate, plant winter wheat, Sept.	Rest	Rest
	Year 2 (2015) (funded by Project GREEEN Pilot Project)			
Crop	Corn silage	Winter Wheat	Perennial pasture mix	Perennial pasture mix
Planting date	Early May	Sept. '14	N/A	N/A
Harvest date	Late Sept.	Early Aug.	Grazing 3-5x	Grazing 3-5x
Post-harvest management	Fall '15 tillage	Plant cover crop mix, graze	Rest	Rest
	Year 3 (2016) (potentially funded by Project GREEEN Pilot Project)			
Crop	Corn silage	Corn silage	Perennial pasture mix	Perennial pasture mix
Planting date	Early May	Early May	N/A	N/A
Harvest date	Late Sept.	Late Sept.	Grazing 3-4x	Grazing 3-5x
Post-harvest management	Fall '16 tillage	Plant cover crop mix, graze	Terminate, plant cover crop mix, Sept.	Rest
	Year 4 (2017) (potentially funded by Project GREEEN Pilot Project)			
Crop	Malt barley	Malt barley	Split: malt barley or potatoes	Perennial pasture mix
Planting date	Early May	Early May	Early May	N/A
Harvest date	Mid August	Mid August	Late Sept.	Grazing 3-5x
Post-harvest management	Fall '17 tillage	Plant cover crop mix, graze	Plant cover crop mix, graze	Rest

Agronomy Research

Michigan Department of Agriculture and Rural Development Variety Trial Project

In 2014, MSU UPREC was awarded $100,000 to expand and diversify the crop variety trial program. Specifically, MDARD's request was to include crops not often grown in the Upper Peninsula, to show their feasibility and potential. The trial included traditional field crops, forage crops, cover crops, and vegetable crops (explained further in the North Farm report).

The crops established at the South Farm are outlined below, and further summarized in the following pages. The malting barley trial can be found on page 34. No data is available for the forage grasses (harvest 2015), alfalfa (harvest 2015), BMR forage sorghum (did not meet maturity), dry edible beans (delayed planting), winter wheat or rye (both harvest 2015).

Table 1. Crops evaluated in MDARD variety trial project

Crop	Varieties	Established	Harvest	Notes
Spring wheat	11	5/22/14	9/16/14	Moisture challenges, lower than expected yields
Barley	23	5/10/14	9/3/14	Moisture challenges, excellent yields
Oats	19	5/14/14	9/3/14	Some lodging issues, very good yields
Field peas	9	5/22/14	9/18/14	Prolific growth – led to difficult harvest, impressed with crop potential
Forage grasses	12	6/27/14	Harvest in 2015	Data available 2015
Alfalfa	12	8/4/14	Harvest in 2015	Re-established after June planting failure
BMR forage sorghum	5	6/30/14	9/17/14	40-day harvest window not met
Cover crop	8 (species) + 1 diverse mix	6/27/14	Winterkill	Conducted Solvita soil sampling, has generated significant interest
Dry edible beans (black)	7	6/27/14	Crop failure[1]	Failure due to late planting and challenging harvest conditions
Winter wheat	35	9/23/14	Harvest in 2015	Largest winter wheat trial ever hosted at UPREC
Rye	3	9/23/14	Harvest in 2015	Substantial winterkill observed May 2015

Spring Wheat

# of Varieties: 11

Planting date: May 22, 2014

Seeding rate: 116 lbs./acre

Fertility: 163 lbs./acre applied at planting (46-0-0)

Herbicide: Buctril applied to control annual weeds at a rate of 1.5 pints/acre

Harvested: September 16, 2014

Table 2. Spring wheat data

Variety	Moisture (%)	Test wt (lbs/bu)	Ht (in)	Bu/acre	Relative Maturity	Origin*
Rollag	15.2	59.4	25.5	29.8	Medium	MN
RB07	15.5	56.6	24.7	27.0	Early	MN
Prosper	15.7	59.3	28.7	34.1	Medium	ND
LCS Powerplay	15.9	59.2	26.5	34.6	Medium	LCS
Norden	16.4	60.2	24.0	31.1	Medium	MN
Linkert	15.5	59.2	25.2	30.2	Medium	MN
LCS Iguacu	16.7	58.8	27.7	31.2	Medium	LCS
Forefront	15.3	58.8	28.5	28.4	Early	SD
Faller	15.2	59.0	29.0	34.1	Medium	ND
LCS Breakaway	15.9	59.6	23.0	28.4	Early	LCS
LCS Albany	16.1	58.1	25.0	29.4	Late	LCS

*MN = Minnesota, ND = North Dakota, LCS = Limagrain Cereal Seed, and SD = South Dakota

Oats

# of Varieties: 17 named + 2 experimental = 19

Planting date: May 14, 2014

Seeding rate: 96 lbs./acre

Fertility: 130 lbs./acre applied at planting (46-0-0)

Herbicide: Buctril (1.5 pts./acre) applied to control annual weeds

Harvested: September 3, 2014

Table 3. Oat data

Variety	Moisture (%)	Test wt (lbs/bu)	Ht (in)	Bu/acre	Relative Maturity	Lodging (0=None, 5=High)	Origin
Badger	16.3	33.2	28.2	63.7	Early	5	WI
Beta-Gene	15.7	34.3	32.7	97.5	Early	2	WI
Deon	15.9	35.6	36.7	89.2	Late	0	MN
Drumlin	15.2	33.8	31.0	85.4	Early	4	WI
Esker	15.3	32.5	29.0	95.9	Early	3	WI
Goliath	15.8	36.9	41.7	80.3	Late	3	SD
Horsepower	15.2	35.1	30.7	88.4	Early	4	SD
Ida	15.9	33.6	31.7	91.4	Early	1	MI
IL 06-5433	15.2	35.3	26.7	93.3	Early	1	Experimental
Kame	15.3	32.0	29.0	91.7	Early	5	WI
Ogle	15.2	32.9	30.0	109.1	Early	1	IL
Ron	16.8	34.6	35.5	95.6	Medium	1	WI
Saber	14.9	34.6	28.7	94.3	Early	4	IL
Shelby 427	15.6	35.3	35.0	62.4	Early	5	SD
Souris	15.4	35.0	30.5	91.1	Early	4	ND
Spurs	15.4	35.7	28.2	88.2	Early	2	IL
Tack	15.3	36.7	29.5	84.6	Early	2	IL
X10097-1	14.5	36.2	26.5	76.8	Early	4	Experimental
X8859-1	15.5	34.0	31.0	92.3	Medium	4	Experimental

Field Peas

# of Varieties: 9

Planting date: May 22, 2014

Seeding rate: 150 lbs./acre

Fertility: 100 lbs./acre applied at planting (21-0-0)

Herbicide: Pursuit applied to control annual weeds at a rate of 1.75 oz./acre

Harvested: September 18, 2014

Table 4. Field pea data

Variety	Moisture (%)	Test wt (lbs/bu)	Bu/acre	Origin
SW Midas	15.0	61.2	56.8	Pulse USA
Arcadia	15.4	60.2	66.5	Pulse USA
Vegas	14.9	60.2	51.7	Pulse USA
DS Admiral	15.0	60.7	61.7	Pulse USA
Mystique	15.7	60.7	56.7	Pulse USA
Nette	15.3	62.1	69.5	Pulse USA
Cruiser	15.0	60.0	66.8	Pulse USA
Matrix	15.2	60.0	49.6	Pulse USA
Korando	15.0	61.2	67.2	Pulse USA

Cover Crop Species Trial

# of species: 8 species + 1 diverse mix

Planting date: June 27, 2014

Seeding rate: Varied

Fertility: N/A

Herbicide: N/A

Harvested: N/A, allowed to winterkill

LSD: 6.25

Table 5. Cover crop species trial data

Species	Seeding Rate (lbs./acre)	Species description	Solvita Reading Basal CO_2 Respiration (CO_2-C ppm)[1]	Ranked Biomass[2]	Ranked Weed Suppression[2]
Annual Rye	20	Cool season grass	32.93	2	3
Chickling vetch	60	Cool season legume	32.40	1	2
Sunn Hemp	20	Warm season legume	29.70	9	9
Egyptian Wheat	10	Warm season grass	27.33	7	7
Diverse Mix[3]	31	Mix	26.24	5	5
Ethiopian Cabbage	6	Brassica	24.82	4	6
I.F. Collards	8	Brassica	24.71	6	4
Cowpeas	55	Warm season legume	23.18	8	8
Buckwheat	60	Broadleaf	19.32	3	1

[1]Solvita test measures CO_2-C in ppm, which measures the respiration of the living organisms in the soil

[2]1 = excellent, 9 = poor

[3]Diverse mix contained 13% annual rye, 19% chickling vetch,10% sunn hemp, 16% Egyptian wheat, 3% Ethiopian cabbage, 3% I.F. Collards, and 19% cowpeas (and buckwheat?)

Results from the trials were distributed in the Ag Connections Newsletter and presented at 8 Extension meetings throughout the U.P. in December 2014 and January 2015. Over 80 producers were in attendance and the data and format was well-received. Presenting Extension personnel, Jim Isleib, Christian Kapp, and Ashley McFarland, were also able to gauge interest on the various crops and receive feedback on additional trials of interest.

Meeting evaluation data

Summarized by Jim Isleib

Table 6. Meeting schedule and details

Date	Location	Time	Comments	Attendance
December 1, 2014	Mass City, Ontonagon Co.	7-8:30 pm		7
December 2, 2014	Crystal Falls, Iron Co.	7-8:30 pm		6
December 9, 2014	Stephenson, Menoninee Co.	11am-1 pm	Lunch included	5
December 10, 2014	Cooks, Schoolcraft Co.	11am-1 pm	Lunch included	7
December 11, 2014	Eben Junction, Alger Co.	11am- 1pm	Lunch included	18
January 6, 2015	Engadine, Mackinac Co.	7-8:30 pm	Snowstorm	12
January 7, 2015	Escanaba, Delta Co.	7-8:30 pm		8
January 28, 2015	Dafter, Chippewa Co.	7-8:30 pm		16
			Total attendance:	79

Respondent demographics:

Of total attendance, 62 were male, 17 were female, all participants who completed USDA civil rights self-disclosure forms indicated ethnicity as 'white'

Table 7. Counties represented by respondents

County	# participants
Alger	13
Baraga	1
Chippewa	16
Delta	10
Houghton	2
Iron	6
Luce	4
Mackinac	7
Marquette	6
Menominee	5
Midland	1
Ontonagon	4
Schoolcraft	4

Table 8. Types of farming operations represented (respondents could select more than one type)

Type of farming operation	# responses	% of total responses
Fresh vegetables and/or fruit	16	24%
Beef	30	45%
Poultry/eggs/meat	8	12%
Dairy	7	11%
Other livestock	17	26%
Hay sales	24	36%
Cash commodity crops	20	30%
Nursery	0	0%
Other (see below for description)	16	24%

66 total respondents

'Other' types of farming operations included: hogs, retail sales, seed, researching what to do next, interested in malt house and barley crop, sugar beets, retired, consulting forester, sheep, pasture of rough land, NRCS (2), sheep (2), beans

Number of acres farmed

56 participants responded for a total of 27,681 acres represented.

- Mean acreage = 494 acres
- Median acreage = 240 acres

Table 9. Crops currently grown by respondents (respondents could select more than 1 crop)

Type of crop	# responses	# of total responses
Barley	18	18%
Spring wheat	5	5%
Winter wheat	11	11%
Oats	28	28%
Dry field peas	8	8%
Alfalfa	20	20%
Cover crops	20	44%

46 total respondents

Table 10. Intention to grow, or expand acreage, of 2015 crops highlighted in the meetings

Type of crop	# responses	# of total responses
Barley	16	46%
Spring wheat	2	6%
Winter wheat	5	14%
Oats	21	60%
Dry field peas	7	20%
Alfalfa	9	26%
Cover crops	13	37%

35 total respondents

Comments from 22 respondents regarding plans for expanded acreage:

- Barley: 8 respondents indicated an average of 30.5 acres planned for 2015
- Winter wheat: 3 respondents indicated an average of 220 acres planned for 2015
- Oats: 10 respondents indicated an average of 46 acres planned for 2015
- Dry field peas: 5 respondents indicated an average of 8 acres planned for 2015
- Alfalfa: 6 respondents indicated an average of 19 acres planned for 2015
- Cover crops: 8 respondents indicated an average of 11 acres planned for 2015

Additional comments to describe acreage expansion:

- Did not get ground plowed-too wet so no small grain planting for 2015
- Interested in putting in a cover crop after hay crop
- Very interested in using cover crops for raising-finishing beef
- Improve soil quality, reduce weeds, organic farming
- Malted barley
- May no-till one field and plow/plant another five acres
- I grow oats no-till with very good yields, but lately fall panicum and foxtail are making it almost impossible
- Rotating crop, developing soil health
- May want to try more of the barley, spring wheat, winter wheat in mixed forage for beef cattle
- Hope to have more tilled acreage with some out of production in cover.
- My grain is feed and primarily cover for new forages - hay and pasture
- Trying to learn what does well
- Use cover to keep weeds under control on open land

Table 11. Respondent preferences on receiving agronomy information from MSU

Preference of delivery method	# respondents	% of total responses
Face-to-face meetings	51	81%
U.P. Ag Connections newsletter	3	5%
Targeted Mailings	2	3%
Webinar	1	1%
Internet (websites/email)	6	10%

63 total respondents

General comments about impact of meetings on respondent's farming operations (30 respondents provided comments):

- Really would like to see trials on clay soil along with grazing trials using cover crops species, much like Dr. Rowntree's work in Lake city in Eastern UP/clay soil areas
- also prefer newsletter (11)
- also prefer webinars (2)
- also prefer internet (3)
- also prefer targeted mailings (6)
- Very glad you're doing these trials on UP relevant crops
- Excellent presentation (2).
- Lots of info and data specific to the U.P.

- Interested in what will work in UP from Econ Dev. standpoint
- I learned about a couple more cover crop varieties a well as the soil respiration test as a valuable measuring tool
- Assists in "selling" conservation practices to local farmers
- Trials on non-gmo products or non-gmo companies would be great
- Might look at malting barley
- Great to have face-to-face updates! See neighbors, catch-up, great to have UPREC reaching out!!! Thanks!
- Great presentations, very well done and informative
- Important information on crop varieties also information from other farmers
- Looking for options besides hay
- Face to face provides best atmosphere for productive feedback, ideas from participants
- Would like more on market information and crop cash value information, More information on what other U.P. producers are doing
- Good meeting, I enjoyed it, like to see triticale trials
- Liked learning about varieties that are more available to the U.P. - i.e. practical use

Potato Variety Trial

Each year, MSU UPREC in partnership with the Michigan Potato Industry Commission, supports an on-farm freshpack potato variety trial in Delta County, Michigan. This past year, the trial was held on the VanDamme Farm near Rock, Michigan. A field day was held in August, along with distribution of results in early-2015.

This table was accessed from the MSU Potato Specialist website: http://potatospecialist.css.msu.edu/.

2014 Freshpack Potato Variety Trial
VanDamme Farms, Delta County, MI

Harvest 7-Oct-14 129 Days

DD, Base 40[5] 2682

	CWT/A		PERCENT OF TOTAL[1]						TUBER QUALITY[2]				TOTAL	VINE	VINE	
LINE	US#1	TOTAL	US#1	Bs	As	OV	PO	SP GR	HH	VD	IBS	BC	CUT	VIGOR[3]	MATURITY[4]	COMMENTS
Reba	**637**	**660**	**96**	**4**	**47**	**49**	**0**	**1.080**	**0**	**0**	**0**	**0**	**10**	**4.0**	**3.5**	
MSS176-1	573	629	91	2	69	22	7	1.077	0	0	0	0	10	4.5	4.5	
Red Norland	**515**	**547**	**94**	**3**	**87**	**7**	**3**	**1.073**	**0**	**0**	**0**	**0**	**10**	**4.5**	**3.0**	
W9133-1Rus	497	596	84	2	40	44	14	1.100	0	0	0	0	10	4.5	3.5	
MSS206-2	491	502	98	1	45	53	1	1.100	0	0	0	0	10	4.0	4.5	
AF4320-7Rus	465	531	88	2	43	45	10	1.085	0	0	0	0	10	4.0	3.5	
ATX91137-1Rus	452	516	88	7	47	41	5	1.077	0	0	0	0	10	3.0	4.0	
Silverton Russet	**447**	**568**	**79**	**8**	**39**	**40**	**13**	**1.085**	**0**	**0**	**0**	**0**	**10**	**4.5**	**3.5**	
MSQ131-A	433	440	99	0	38	61	1	1.078	0	0	0	0	10	4.5	4.0	
MSS576-5SPL	432	488	88	6	66	22	6	1.076	0	0	0	0	10	4.5	3.5	
Russet Norkotah LT	**427**	**464**	**92**	**5**	**49**	**43**	**3**	**1.075**	**0**	**0**	**0**	**0**	**10**	**3.0**	**3.0**	**gc in pickouts**
W6703-1Y (Oneida Gold)	422	442	96	1	90	6	3	1.080	0	0	0	0	10	4.0	3.0	
A03921-2Rus	409	497	82	12	50	32	6	1.078	0	0	0	0	10	3.0	5.0	
A06021-Trus	407	489	83	8	61	22	9	1.073	0	0	0	0	10	3.0	5.0	
MSM288-2Y	396	417	95	5	81	14	0	1.076	0	0	0	0	10	3.5	3.5	
W8152-1Rus	337	405	83	14	63	20	3	1.082	0	0	0	0	10	4.5	3.5	
W9433-1Rus	316	339	93	4	37	56	3	1.082	0	0	0	0	10	4.0	4.5	
AF4124-7Rus	311	436	71	12	37	34	17	1.085	0	0	0	0	10	4.5	4.5	
MSQ086-3	299	315	95	5	77	18	0	1.076	0	0	0	0	10	2.5	4.0	
CO05228-4R	283	331	86	9	82	4	5	1.085	0	0	0	0	10	2.5	3.5	
AF3362-1Rus	228	274	83	3	41	42	14	1.076	1	0	0	0	10	3.5	3.0	
Russet Norkotah	**178**	**264**	**68**	**21**	**56**	**12**	**11**	**1.075**	**0**	**0**	**0**	**0**	**10**	**3.5**	**3.0**	**gc in pickouts**
MEAN	**407**	**461**						**1.081**								**tr = trace, sl = slight, N/A = not applicable**
																SED = stem end defect, gc = growth crack

[1]SIZE
Bs: < 1 7/8" or <4oz.
As: 1 7/8" - 3.25" or 4-10oz.
OV: > 3.25" or >10oz.
PO: Pickouts

[2]TUBER QUALITY (number of tubers per total cut)
HH: Hollow Heart
VD: Vascular Discoloration
IBS: Internal Brown Spot
BC: Brown Center

[3]VINE VIGOR RATING
Date Taken: 10-Jul-14
Ratings: 1 - 5
1: Slow Emergence
5: Early Emergence (vigorous vine, some flowering)

[4]VINE MATURITY RATING
Date Taken: 27-Aug-14
Ratings: 1 - 5
1: Early (vines completely dead)
5: Late (vigorous vine, some

Planted:	31-May-14
Vines Killed:	15-Sep-14
Days from Planting to Vine Kill:	107
Seed Spacing :	12"
No Fumigation	

[5]MAWN STATION: Escanaba
Planting to Vine Kill

Corn Variety Trial

Weather at harvest in 2014 proved exceptionally difficult for corn. Each year, MSU UPREC participates in the statewide MSU corn variety trial program with locations in Delta, Menominee, and at the Center in Alger County. Typically in Menominee varieties of both grain and two maturities of corn silage are tested, however the crop in 2014 was unable to be harvested due to an early frost followed by very wet conditions. Similar conditions inhibited harvest at the Alger location as well. The only harvestable plot was the corn silage located in Delta County (corn silage varieties 102 day and earlier). The following table was accessed from the 2014 Michigan Corn Hybrid Report: http://www.varietytrials.msu.edu/corn.

TABLE 10. ALGER, DELTA & MENOMINEE (EARLY) COUNTY SILAGE TRIALS (102 Day and Earlier) ZONE 5

2014				Alger										Delta										Menominee - Early									
				YIELD				% QUALITY						MILK 2006		YIELD				% QUALITY						MILK 2006		YIELD				% QUALITY						MILK 2006	
BRAND / HYBRID	RM	TRT	TRAIT	%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	MK/T	MK/A	%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	MK/T	MK/A	%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	MK/T	MK/A
GREAT LAKES 4250STX	92	P500	1,2,3,6													28.4	21.7	6.2 *	100	76.8	28.1	54.0	57.1	10.0	16.0	2910	17895												
GREAT LAKES 4879STXRIB	98	P500	1,2,3,6													24.9	21.9	5.5	98	76.0	31.3	59.9	59.9	10.1	7.4	2662	15257												
GREAT LAKES 5015STXRIB	100	P500	1,2,3,6					Not Harvested								25.2	22.1	5.9 *	100	74.8	32.7	60.3	58.2	9.4	5.7	2460	14447					Not Harvested							
MYCOGEN TMF2Q413	96	C250	1,2,4,6					Early Frost								27.7	22.6	6.3 **	100	75.3	32.3	58.5	57.7	9.2	9.1	2606	16366					Early Frost							
MYCOGEN TMF2R196	86	C250	1,2,3,4,6					Wildlife Damage								28.7	19.9	5.7	94	77.8	29.0	54.6	59.4	9.4	14.5	2832	17016					Late Water Damage							
NuTech 3A-496™	96	C500	1													24.0	21.2	5.1	85	73.9	34.4	62.5	58.3	8.7	3.5	2342	11834												
NuTech 5B-290™	90	C500	1,2,4													25.7	22.8	5.9 *	100	73.3	31.8	58.9	54.7	9.4	9.6	2564	15000												
NuTech 5V-195™	95	C500	1,2,3,4													26.4	20.9	5.5	100	77.0	29.4	56.4	59.3	9.8	6.8	2592	14302												
NuTech/G2 GENETICS 5F-198™	98	P500	1,2,4													29.0	21.0	6.1 *	100	75.8	30.7	56.3	57.1	8.9	15.4	2837	17257												
NuTech/G2 GENETICS 5F-399™	99	P500	1,2,4													27.5	21.2	5.8 *	98	75.7	31.7	59.0	58.2	9.2	11.2	2740	15156												
NuTech/G2 GENETICS 5X-894™	94	P500	1,2,3,4													28.5	19.8	5.6	98	76.4	29.1	54.4	56.8	9.7	19.6	2885	16943												
NuTech/G2 GENETICS 5Y-196™	96	P1250	1,2,3,4													27.7	20.1	5.6	99	72.2	33.2	59.0	53.0	8.8	12.9	2817	15343												
PIONEER P0236XR	102	C250	1,2,3,4,6,7													23.0	20.7	4.8	100	81.6	29.0	55.7	66.9	10.5	6.6	2657	12614												
PIONEER P9789AMXT	97	C250	1,2,3,4,6													27.9	18.0	5.0	81	74.3	31.6	57.3	55.3	10.3	15.1	2743	12812												
SPECTRUM 4855	96		Conv.													26.2	19.5	5.1	96	72.2	33.2	61.5	54.7	9.1	6.9	2471	12598												
SPECTRUM 5045	100	C250														29.3	20.3	6.0 *	96	73.5	33.1	59.4	55.5	8.7	12.8	2858	14844												
AVERAGE																26.9	20.8	5.6	96.5	75.4	31.3	57.9	57.6	9.4	10.9	2661	14980												
HIGHEST																29.3	22.8	6.3	100.0	81.6	34.4	62.5	66.9	10.5	19.6	2910	17895												
LOWEST																23.0	18.0	4.8	80.6	72.2	28.1	54.0	53.0	8.7	3.5	2342	11834												
CV (%)																4.9	5.6	8.1	3.1	3.0	7.2	5.5	3.7	6.8	22.0	5	8												
LSD (5%)																1.6	1.4	0.5	3.5	2.7	2.7	3.8	3.6	0.8	2.9	146	1419												

2 Year Averages 2014 - 2013				Alger										Delta										Menominee - Early									
				YIELD				% QUALITY						MILK 2006		YIELD				% QUALITY						MILK 2006		YIELD				% QUALITY						MILK 2006	
BRAND / HYBRID	RM	TRT	TRAIT	%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	MK/T	MK/A	%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	MK/T	MK/A	%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	MK/T	MK/A
GREAT LAKES 4879STXRIB	98	P500	1,2,3,6													26.6	23.4	6.3 *	99	77.9	27.2	51.8	56.8	9.2	20.2	2891	18705												
GREAT LAKES 5015STXRIB	100	P500	1,2,3,6													27.1	22.3	6.1	99	77.0	28.3	52.3	55.5	8.8	19.5	2771	17078												
MYCOGEN TMF2Q413	96	C250	1,2,4,6													29.1	22.4	6.5 *	100	77.1	27.9	51.0	54.6	8.7	21.8	2841	18382												
NuTech 3A-496™	96	C500	1													25.5	23.5	6.0	92	75.8	30.2	55.9	56.5	8.5	14.2	2640	16162												
NuTech 5B-290™	90	C500	1,2,4													29.4	22.5	6.6 **	100	77.3	25.9	48.2	52.5	8.9	25.3	2916	20218												
AVERAGE																27.6	22.8	6.3	98.1	77.0	27.9	51.8	55.2	8.8	20.2	2812	18109												
HIGHEST																29.4	23.5	6.6	100.0	77.9	30.2	55.9	56.8	9.2	25.3	2916	20218												
LOWEST																25.5	22.3	6.0	92.4	75.8	25.9	48.2	52.5	8.5	14.2	2640	16162												
CV (%)																5.2	5.6	7.9	3.1	2.8	6.6	5.1	4.8	6.1	14.3	4	8												
LSD (5%)																1.2	1.0	0.4	2.5	1.8	1.6	2.3	3.2	0.5	2.0	102	1147												

** Highest Yielding Hybrid

* Not Significantly Different from Highest Yielding Hybrid

Forage Variety Trials

Each year, MSU UPREC participates in the statewide forage variety test program. Weather in 2014 was cool and wet in Chatham, although it did allow for three harvests of forage grasses and alfalfa varieties. The entire MSU Forage Variety Test Report can be accessed at: http://forage.msu.edu/. The following tables summarize data collected at the UPREC in 2014.

Table 6. Long-term yield averages (dry matter tons/acre) from MSU Alfalfa Variety Trials seeded in Chatham, Michigan in 2008, 2009, 2012 and 2013.

		3-yr average		2-yr total	1-yr total	(Number) †
Variety	Marketer	2008	2009	2012	2013	% Vernal ††
		------ dry matter tons/acre ------				
6417	NEXGROW	3.73	-	-	-	(1)107
6431	NEXGROW	3.64	-	-	-	(1)104
4A421	Mycogen Seeds	-	3.10	-	-	(1)107
Ameristand 403T Plus	America's Alfalfa	-	3.07	-	-	(1)106
Ameristand 407TQ	America's Alfalfa	3.45	2.96	-	-	(2)100
DG 4210	Crop Production	-	-	-	4.15	-
DKA 33-16	Monsanto	3.70	-	-	-	(1)106
DKA 43-13	Monsanto	-	3.23	-	-	(1)111
Evergreen 3	NEXGROW	3.23	-	-	-	(1)92
ForageGold	Renk Seed	-	-	3.03	-	-
Mariner IV	Allied Seed	-	-	2.89	-	-
Pioneer 53H92	Pioneer	-	2.88	-	-	(1)99
Pioneer 54Q32	Pioneer	-	3.28	-	-	(1)113
Pioneer 55V12	Pioneer	-	3.25	3.23	-	(1)112
Pioneer 55V48	Pioneer	3.42	2.96	-	-	(2)100
Pioneer 55V50	Pioneer	-	-	3.56	3.92	-
SolarGold	Renk Seed	-	-	3.58	-	-
Velocity	Nutech Seed	3.55	3.05	-	-	(2)103
Vernal	Public	3.50	2.90	3.16	4.18	(2)100
WL343HQ	W-L Research	3.55	-	-	-	(1)101
5312	check	-	3.27	-	4.08	(1)113
DK140	check	3.40	3.01	-	-	(2)100
Mean		**3.52**	**3.08**	**3.24**	**4.08**	**104**

† Number of 3-year trials with at least 2 years of data after the seeding year.
†† Average % Vernal of varieties with more than 2 full years of yield data

Table 8. First-year yields (dry matter tons/acre) of Roundup Ready Alfalfa Varieties seeded in 2013 in East Lansing, Lake City, and Chatham, Michigan.

		2014 First-year total yields		
Variety	Marketer	East Lansing	Lake City	Chatham
		---------- dry matter tons/acre ----------		
428RR	Allied Seed	6.42	-	-
6497R	NEXGROW	6.46	-	-
AmeriStand 455TQ RR	America's Alfalfa	6.22	-	-
RR Stratica	Croplan Genetics	6.48	-	-
WL 356HQ.RR	W-L Research	6.49	-	-
WL 372HQ.RR	W-L Research	6.38	-	-
Pioneer 54QR04	Pioneer	6.47	3.51	-
DKA41-18RR	Monsanto	6.40	3.51	4.21
DKA44-16RR	Monsanto	6.53	3.38	3.93
Yieldmaster RR	Monsanto	6.33	3.35	4.19
Mean		**6.42**	**3.44**	**4.11**

† 2013 seeding cut 4 times at East Lansing, three cuttings each at Lake City and Chatham in 2014

Table 17. 2014 yield summary (DM tons/acre) of MSU Alfalfa Variety Trial seeded in Chatham, Michigan, in August 2012.

	2014				2013	Grand
Entry	June 19	July 31	Sept 17	Total	Total	Total
SolarGold	1.90	1.33	0.54	3.77*	3.39	7.16
Pioneer 55V50	1.60	1.20	0.60	3.39*	3.73	7.12
Pioneer 55V12	1.40	1.11	0.54	3.05*	3.40	6.45
Vernal	1.75	0.97	0.49	3.22*	3.09	6.30
ForageGold	1.44	0.85	0.51	2.80*	3.25	6.05
Mariner IV	1.36	0.88	0.48	2.71	3.06	5.77
Mean	**1.58**	**1.06**	**0.53**	**3.16**	**3.32**	**6.48**
LSD 0.05	0.59	0.57	0.21	1.01	0.85 ns	1.71 ns
CV%	24.9	36.1	27.2	21.7	17.1	17.5

* Yield is not statistically different from the greatest value in the column.
ns - Yields among varieties in this column trial are not statistically different.

Table 20. 2014 yield summary (DM tons/acre) of MSU Conventional Alfalfa Variety Trial seeded in Chatham, Michigan, in July 2013.

	2014			
Entry	June 19	July 31	Sept 17	Total
Vernal	1.62	1.28	1.29	4.18
DG 4210	1.60	1.35	1.20	4.15
5312	1.57	1.33	1.18	4.08
Pioneer 55V50	1.46	1.45	1.01	3.92
Mean	1.56	1.35	1.17	4.08
LSD 0.05	0.31	0.26	0.35	0.52 ns
CV%	12.3	12.0	18.7	8.0

ns - Total yield among varieties in this trial are not statistically different.

Table 23. 2014 yield summary (DM tons/acre) of MSU Roundup Ready Alfalfa Variety Trial seeded in Chatham, Michigan, in July 2013.

	2014			
Entry	June 19	July 31	Sept 17	Total
DKA 41-18RR	1.64	1.32	1.24	4.21
Yieldmaster RR	1.63	1.36	1.20	4.19
DKA 44-16RR	1.49	1.26	1.18	3.93
Mean	**1.59**	**1.31**	**1.21**	**4.11**
LSD 0.05	0.35	0.13	0.23	0.63 ns
CV%	12.9	5.7	10.8	8.9

ns - Total yield among varieties in this trial are not statistically different.

Malting Barley Research

The craft brewing industry in Michigan is growing at an astounding rate, with over 200 breweries already in production. The economic windfall of this phenomenon has been a tremendous asset to our agriculturally-rich state, which touts the second most diverse line-up of agricultural products in the country. The state's brewing industry contributes over $232 million in wages with a total economic impact of more than $608 million. In terms of overall number of breweries, microbreweries and brewpubs, Michigan ranks fifth in the nation – thus supporting its claim as "The Great Beer State." It is quite evident that the craft brewing industry is a mainstay in the economy.

Consumers that have fueled the upward trend in craft beer consumption are now seeking a more locally sourced product. As in the entire food industry, the concept of local food has generated a high level of interest and demand. In response, farmers throughout Michigan want to grow malting barley to supply this demand. MSU UPREC has been working over the last three years conducting research to support the growth of malting barley acres in Michigan, especially in the Upper Peninsula. In addition to variety trials, management practices such as fertility recommendations and fungicide use have been studied. In order for the malting barley industry to thrive in Michigan, suitable processing is also necessary. UPREC staff has been working with start-up malthouses throughout the state and are confident that there will be a major increase in available processing by the end of 2015 – from 2 malthouses to 6, including one in the Upper Peninsula.

The following deliverables have been produced in 2014 to support this emerging industry:

- MSU UPREC Malting Barley website to house research, resources, and contact information http://agbioresearch.msu.edu/centers/uprc/malting_barley
- Malting Barley Production in Michigan guide http://agbioresearch.msu.edu/uploads/396/36753/Research_Files/Malting_Barley_Production_in_Michigan_-_GMI035.pdf
- Malthouse feasibility study produced by the MSU Product Center http://agbioresearch.msu.edu/uploads/396/36753/Research_Files/Malt_House_Feasibility_Study_JFW_-_FINAL.pdf
- Four location malting barley variety trial held in Alger, Schoolcraft, Leelanau, and Presque Isle Counties http://agbioresearch.msu.edu/uploads/396/61579/2014_MSU_Malting_Barley_Trial_Results_UPREC-Posen.pdf
- Great Lakes Hop and Barley Conference, Grand Rapids, Michigan – April 10th – 11th http://events.anr.msu.edu/event.cfm?folder=hopandbarley15
- Personal contact via phone and email with over 100 farmers and processors that want to enter the malting barley and malt industry.

The following pages provide data from two locations of the variety trial in 2014. We greatly appreciate the multiple support streams that made this trial happen: Michigan Department of Agriculture and Rural Development, MSU Project GREEEN, and the American Malting Barley Association.

Michigan Malting Barley Variety Trial 2014
Upper Peninsula Research & Extension Center., Chatham, MI
Latitude: 46.35° N Longitude: 86.94° W

Variety	Moisture (%)	Test wt (lbs/bu)	Ht (in)	Bu/acre*	Heading date**	Type	Origin†
2B05-0811	15.8	47.9	25.0	92.1	193	2 row	Experimental
2B09-3425	15.6	48.2	23.4	89.5	193	2 row	Experimental
2ND25276	15.7	47.9	24.9	81.4	190	2 row	Experimental
ABI Voyager	16.5	47.6	25.3	83.9	201	2 row	BARI
AC Metcalfe	15.7	49.5	23.6	79.4	193	2 row	Can
Celebration	15.4	50.1	24.3	86.6	188	6 row	BARI
Conlon	15.8	51.1	23.0	76.2	186	2 row	ND
Conrad	15.9	50.0	22.8	87.1	199	2 row	BARI
Innovation	15.8	50.9	25.5	88.9	186	6 row	BARI
Lacey	15.9	51.9	22.6	87.1	188	6 row	MN
LCS Genie	17.2	49.7	20.8	83.3	199	2 row	LCS
Legacy	16.0	47.5	26.8	93.8	188	6 row	BARI
Merit	17.0	48.5	23.9	73.8	199	2 row	BARI
Merit 57	16.5	48.9	26.1	89.2	193	2 row	BARI
NSA 1820	16.5	51.1	20.5	91.0	201	2 row	LG
Odyssey	17.2	48.5	18.4	99.7	199	2 row	LG
Overture	17.0	49.0	20.3	85.3	201	2 row	LG
Pinnacle	16.8	48.5	24.2	91.2	188	2 row	ND
Quest	15.5	50.7	27.6	93.3	186	6 row	MN
Rasmusson	16.0	50.7	23.6	96.1	188	6 row	MN
Robust	16.0	50.6	24.1	74.7	188	6 row	MN
Stellar ND	15.5	48.1	24.6	82.6	186	6 row	ND
Tradition	15.4	50.4	25.3	89.2	186	6 row	BARI
Mean	16.1	49.4	23.8	86.8			
CV%	2.7	1.6	7.8	11.9			
LSD 5%	0.6	1.1	2.6	14.6			

Seeded: 5-10-14
Seeding rate: 96 lbs/ac
Fertility: 108 lbs/ac of 46-0-0
Previous crop: Soybeans (unable to harvest due to inclement weather)
Herbicide: 11 oz/ac Huskie
Fungicide: 8.2 oz/ac of Prosaro at Feekes stage 10.5
Soil type: Eben very cobbly sandy loam
Harvested: 9-3-2014
Design: RCB, plot size 3 x 20', (3 x 18' harvested)

*Yield adjusted to 13.5% moisture
**Julian calendar date of heading at approximately 50% of spikes
Origin† BARI- Busch Agricultural Resources, Inc.; MN- University of Minnesota; LG- Limagrain; ND- North Dakota State University; LCS- Limagrain Cereal Seeds

Michigan Malting Barley Variety Trial 2014
Upper Peninsula Research & Extension Center., Chatham, MI
Selected quality analysis results

Variety	Protein	RVA	GE (%)	DON	S/T %	DP (°ASBC)	Alpha-amylase	Beta-glucan (ppm)	FAN (ppm)
2B05-0811	11.8	4.8	70.5	0.01	55.5	64	75.7	475	443
2B09-3425	12.3	4.8	79.5	0.01	55.4	80	82.1	190	483
2ND25276	11.6	8.7	88.5	0.08	45.5	71	67.0	281	264
ABI Voyager	12.3	4.3	60	0.00	61.5	66	63.4	146	439
AC Metcalfe	13.2	5.0	78	0.01	53.4	90	80.4	177	364
Celebration	13.7	29.2	91	0.01	40.1	127	73.9	208	261
Conlon	13.6	10.2	76.5	0.00	37.6	81	56.1	644	234
Conrad	13.5	4.8	78	0.10	50.1	87	70.5	240	354
Innovation	13.6	13.6	96.5	0.01	38.5	104	58.4	311	247
Lacey	12.5	82.2	96.5	0.00	37.0	112	57.2	216	187
LCS Genie	11.6	111.5	63	0.00	36.4	64	43.7	468	173
Legacy	12.7	4.3	80	0.01	51.5	87	64.7	186	344
Merit	12.1	6.9	85.5	0.00	49.0	77	72.2	433	315
Merit 57	11.9	7.8	87.5	0.02	50.3	75	71.6	300	319
NSA 1820	12.3	77.3	54	0.02	35.2	70	38.3	598	207
Odyssey	12.0	95.9	65	0.01	33.7	50	28.7	765	181
Overture	12.2	71.9	67	0.02	38.8	65	40.2	562	224
Pinnacle	10.8	13.2	70.5	0.01	43.4	63	31.2	547	214
Quest	12.2	70.2	69.5	0.00	40.5	113	42.7	510	221
Rasmusson	13.1	127.1	91.5	0.01	37.8	114	67.8	382	229
Robust	13.5	91.5	75	0.01	35.2	95	52.2	577	207
Stellar ND	12.1	4.3	92.5	0.00	41.8	106	71.3	240	244
Tradition	12.9	60.0	75	0.02	35.0	126	64.4	547	197

Michigan Malting Barley Variety Trial 2014
Cooperator: Julian Pilarski., Posen, MI
Latitude: 45.26° N Longitude: 83.69° W

Variety	Moisture (%)	Test wt (lbs/bu)	Ht (in)	Bu/acre*	Heading date**	Type	Origin†
2B05-0811	15.5	51.4	20.5	88.2	197	2 row	Experimental
2B09-3425	15.2	50.7	17.5	88.7	193	2 row	Experimental
2ND25276	15.5	51.9	20.9	91.6	182	2 row	Experimental
ABI Voyager	15.6	51.9	19.6	82.9	189	2 row	BARI
AC Metcalfe	15.4	52.2	20.3	83.9	182	2 row	Can
Celebration	15.1	50.8	20.0	66.8	179	6 row	BARI
Conlon	15.0	52.7	20.6	70.0	178	2 row	ND
Conrad	15.2	52.2	22.0	83.5	197	2 row	BARI
Innovation	15.1	51.0	22.1	75.0	178	6 row	BARI
Lacey	15.1	51.5	22.4	76.7	180	6 row	MN
LCS Genie	15.0	52.9	18.0	85.7	197	2 row	LCS
Legacy	14.9	50.8	21.8	73.8	181	6 row	BARI
Merit	15.6	51.6	20.2	90.5	197	2 row	BARI
Merit 57	15.4	51.7	19.2	84.3	186	2 row	BARI
NSA 1820	15.3	52.5	19.0	78.5	195	2 row	LG
Odyssey	15.3	51.7	19.5	93.5	197	2 row	LG
Overture	14.9	52.6	18.0	90.9	197	2 row	LG
Pinnacle	15.4	51.1	19.1	77.1	182	2 row	ND
Quest	15.0	50.8	21.8	81.4	180	6 row	MN
Rasmusson	15.2	51.6	20.4	83.1	180	6 row	MN
Robust	15.1	50.9	24.3	69.7	181	6 row	MN
Stellar ND	15.0	49.3	19.1	76.2	181	6 row	ND
Tradition	15.0	50.7	22.4	73.5	178	6 row	BARI
Mean	15	51.4	20.3	81.1			
CV%	10.5	1.1	13.7	12.4			
LSD 5%	2.2	0.8	3.9	14.2			

Seeded: 5/7/2014
Seeding rate: 96 lbs/ac
Fertility: 108 lbs/ac of 46-0-0
Previous crop: Soybeans
Herbicide: 11 oz/ac Huskie
Fungicide: 8.2 oz/ac of Prosaro at Feekes stage 10.5
Harvest Date: 8/28/2014
Soil type: Omena fine sandy loam

*Yield adjusted to 13.5% moisture
**Julian calendar date of heading at approximately 50% of spikes
Origin† BARI- Busch Agricultural Resources, Inc.; MN- University of Minnesota; LG- Limagrain; ND- North Dakota State University; LCS- Limagrain Cereal Seeds

Michigan Malting Barley Variety Trial 2014
Cooperator: Julian Pilarski., Posen, MI
Selected quality analysis results

Variety	Protein	RVA	GE (%)	DON	S/T %	DP (°ASBC)	Alpha-amylase	Beta-glucan (ppm)	FAN (ppm)
2B05-0811	10.7	8.3	89	0.00	48.3	107	82.2	387	287
2B09-3425	11.0	7.4	75	0.01	47.0	124	84.6	136	302
2ND25276	10.5	17.7	96	0.04	42.3	115	76.2	246	223
ABI Voyager	11.3	8.7	81	0.00	51.0	129	80.8	142	315
AC Metcalfe	11.4	7.3	76	0.02	43.7	128	90.4	118	287
Celebration	12.3	81.2	100	0.11	44.0	165	73.3	257	271
Conlon	11.4	92.8	98	0.00	40.1	113	67.8	639	209
Conrad	11.7	7.1	90	0.00	49.4	135	85.9	155	323
Innovation	12.4	85.2	97	0.01	43.0	167	60.9	418	253
Lacey	12.4	102.1	100	0.00	40.7	158	60.6	368	233
LCS Genie	10.4	149.0	97	0.01	39.6	109	51.0	101	194
Legacy	12.2	13.2	96	0.00	47.7	147	73.8	376	289
Merit	10.0	8.0	91	0.00	48.5	103	97.0	163	249
Merit 57	10.8	6.6	87	0.01	49.9	88	103.8	161	273
NSA 1820	10.6	106.1	97	0.01	36.9	88	62.0	83	173
Odyssey	10.1	151.9	99	0.00	38.6	71	54.9	109	167
Overture	10.5	86.2	98	0.01	40.6	74	66.2	163	194
Pinnacle	10.2	116.1	91	0.00	41.7	70	58.1	515	191
Quest	12.4	153.3	98	0.00	43.9	139	67.3	540	234
Rasmusson	12.7	158.8	99	0.00	43.4	142	66.0	341	244
Robust	12.5	62.3	99	0.00	40.8	143	55.2	343	232
Stellar ND	11.9	27.2	96	0.00	42.6	154	64.5	209	229
Tradition	12.6	104.1	96	0.00	41.0	174	66.2	316	223

Research outlook

The 2015 field season will see a dramatic increase in the amount of malting barley research hosted at UPREC. The research program was awarded a Project GREEEN grant to look at the challenging issue of pre-harvest sprout (PHS). This condition occurs when mature grain in the field becomes too wet before harvest and initiates the germination process. This significantly degrades the quality of the grain for malting purposes, because it has already started the malting process, which maltsters prefer to control within their malthouse. In extreme cases, the barley becomes unusable for the malting process. This challenge occurs throughout Michigan because of our humid climate and frequent rainfall. A majority of the malting barley varieties available were bred for a much different, arid climate for the western US, where they prefer low germinative dormancy levels because they do not have the same concerns of sprout in the field. This requires barley grown for malt in the Midwest to be managed quite differently. The trial will look at harvesting mature grain at higher than optimum moisture levels and attempting different drying methods to determine the impact on quality.

Another trial hosted at UPREC will test the recommended seeding rate (currently at 96 pounds/acre). Various seeding rates will be used and observations on stand initiation, disease pressure, moisture and yield will be collected. Researchers at UPREC are hoping to either confirm or establish a refined seeding rate recommendation based on this work.

There are multiple variety trial efforts also ongoing at the farm:

Eastern Spring Barley Nursery

The ESBN was established in 2015 to help identify existing barley varieties that may have adaptation in the eastern US. The barley improvement program at North Dakota State University (NDSU) is coordinating the nursery. The 2015 ESBN includes 20 barley varieties from eight different breeding programs and is being grown by Cornell University, Michigan State University, Ohio State University, Penn State University, Purdue University, University of Maine, University of Massachusetts Amherst, and University of Vermont. This region currently has 13 craft malt plants operating and 10 additional that are in the construction or planning phases. Additionally, these states currently have 819 craft brewers in operation.

To ensure the success of the nursery in each state, it is sown and managed locally by a university or extension person with experience conducting research on small grains. Data will be collected on days to heading, plant height, foliar diseases, lodging, and yield. Following harvest, a sample of each entry from each location will be sent to NDSU where kernel plumpness, grain protein, test weight, pre-harvest sprouting, DON accumulation are determined. Grain from three locations will be malted at NDSU and data will be collected on malt extract, wort color, wort protein, Kolbach Index, wort ß-glucan, diastatic power, α-amylase activity, and free amino nitrogen concentration.

All data from the trial will be compiled into a final report that can be used by local university/extension personnel to educate their growers and other stakeholders on varieties that perform best in their region. The data also can be used by barley breeding programs to identify other varieties or advanced breeding lines that may be candidates for production in the region.

Collaboration with John Innes Research Centre

Researchers at the John Innes Research Centre in Norwich, UK are leading a research collaborative with U.S. and Canadian partners to examine historical barley cultivars and their potential for Fusarium head blight (FHB) resistance. FHB is the leading disease concern in Midwest malting barley. In 2015, six varieties were planted and will be examined for adaptability to the Upper Peninsula climate. In the future, upwards of 300 lines will be grown at UPREC to help identify potential genetics to develop FHB resistant varieties. Partnering organizations (MSU, Cornell, Agrifood Canada, Virginia Tech, and Penn State) will come together to share research efforts as well.

Spartan barley

Spartan, the only malting barley variety bred at Michigan State University, was released in 1916. Although it was widely used throughout the Midwest, by the 1950s it was generally replaced by more modern varieties. Because of the "local" and "Michigan-grown" interest within the craft beer industry, Spartan barley is being revisited as a potential variety. Dr. Russ Freed was able to secure five grams of Spartan barley seed from the USDA gene bank in Utah and grew it out in the greenhouse to produce seed for a field trial. That seed is currently being grown at MSU UPREC and will be analyzed for malting barley quality characteristics, along with its potential ability to be a prosperous variety for Michigan farmers.

The North Farm

The North Farm, which was the original site of the Michigan State College Sub-Station established in 1899, has found new purpose after being dormant for nearly thirty years. The land and buildings have been converted to a teaching farm in order to train the next generation of producers to supply the local food system. With a focus on nutrient dense food production, organic methods are practiced and various season extension technologies are employed to make the most of a very narrow growing season. In addition to the educational offerings, research is ongoing at the site to develop best management practices for local food production – focusing on season extension methods, cold storage, and cold tolerant variety selection.

Extension workshop series

The Skill-Seeker Workshop series had its debut in the 2015 season with eight sessions hosted at the North Farm. Staff provides information and resources to individuals interested in learning more about a wide variety of topics related to northern latitude vegetable production, sustainable agricultural practices, and small farm management. These workshops range from two to three hours and provide detailed technical information, as well as hands-on experiences and demonstrations. Workshops are open to the general public and are designed to assist those interested in improving or establishing commercial operations in small-scale agriculture. To date, over 100 individuals have attended the workshops. The workshop schedule includes the following:

- April 11 – Siting and Planning for Hoophouse Construction
- May 2 – Transplant Production
- May 16 – Low-Cost Season Extension
- July 18 – Tools for the Small Farm
- August 8 – Post-Harvest Handling
- September 26 – Cold Storage
- October 17 – Soil Health and Cover Crop Rotations
- November 7 – Scheduling and Production Planning

School tours

The North Farm has served as a destination for several local school groups as they sought off-campus experiences for their students. These visits have included presentations, hands-on experiences, and a wide variety of activities to encourage exploration and interest in food systems and agriculture. Groups have ranged from elementary age to university students, and have allowed the North Farm and UPREC to partner with several local organizations to develop age appropriate curriculum and activities. Over 300 students from 8 different schools have benefited from this experience. One program that has proven to be a great success is the Start Seeds, Save Seeds program developed in cooperation with the Marquette Food Co-op and Transition Marquette. This program provided teachers with the tools necessary to establish and improve production and seed saving gardens on their schools' campuses. The North Farm provided materials and information to schools, as well as offered site visits, which allowed

students to see the process of producing seedlings. Three schools participated in the pilot program and there is significant interest in a continuation of this program in coming years.

Hosting events/meetings

A large portion of the first year on the North Farm site has been dedicated to developing and improving infrastructure. This has included a significant overhaul of The Grange, a historic barn that now houses the farm's washing and packing facility as well as an upstairs venue for meetings and events.

The North Farm has become a location of interest for groups within community food systems, as well as those in other areas of work. The beautiful setting and convenient location has encouraged local and regional groups to use the farm as a location to host meetings and events for their organizations or groups. The North Farm has provided a venue for farm dinners that feature local products, as well as a wide variety of tours and Q&A sessions for groups with an interest in the progress at the farm. As the infrastructure continues to develop, there will be more opportunities for groups to use the facility to host events and meetings.

Apprentice Farmer Incubator Program

Bean Pole Farm

Landen Tetil is the newest farmer in Chatham, operating under the name Bean Pole Farm. The farm was made possible through the farm incubator program at the North Farm and Michigan State University. She chose to enter into this apprenticeship program because of the location, the timing, and the desire to really dive into a career in sustainable agriculture. Landen has been fortunate enough to live around agriculture her whole life. Growing up, she spent countless summer days on her grandparents' farm; as a teenager, she worked on a hybrid corn and soybean farm and during the summer while in college she worked on an organic vegetable farm. These experiences, along with a never-ending thirst for dirt under her fingernails, have contributed to the advent of Bean Pole Farm.

Landen is a 2013 Northern Michigan University graduate, earning her B.S. in Environmental Studies and Sustainability. After graduation, Landen moved to northcentral Wisconsin, where she began to study the art of permaculture and received her Permaculture Design Certificate last September. These teachings of sustainable life systems and closed-loop functions spurred a shift in her, and a determined search to begin a career in sustainable agriculture commenced. When word got out of a new farm incubator opening in the Upper Peninsula, she knew it was time to bid Wisconsin farewell and begin her journey as a small-scale organic vegetable farmer.

Bean Pole Farm, while now in its fledgling stages, has big plans for its future. Following the permaculture principles, the farm's main goals include becoming a fully self-sustaining closed-loop system, thriving off the natural inputs a working farm provides, while absorbing the outputs in a cyclic pattern. Beyond that, Landen's dream is to provide a whole-diet food share, based on a CSA model and including every part of the human diet. Components will include grains, protein, vegetables, fruit, nuts, herbs and a form of sweetness. In addition to these goals, Landen hopes that one day Bean Pole Farm will be an educational farm, where the community can gather and learn about food, sustainable life systems and farming. Landen and Bean Pole Farm can be reached at beanpolefarm@gmail.com or on Facebook at www.facebook.com/beanpolefarm.

2014 MDARD Variety Trials

The same grant dollars that funded field crop, cover crop, and forage crop trials provided support to perform variety testing for a wide range of vegetable crops. These crops included warm and cool season varieties to demonstrate and determine which performed well in the conditions present at The North Farm site. The intent was to provide vegetable producers with a baseline of data that will help with variety selection when growing in similar conditions. All crops were grown using organic production practices and were either produced in the hoophouses at the farm site or in the field plots.

Table 1. Overview of vegetable crops grown in variety trials at the North Farm in 2014

Crop	# of Varieties Tested	Location	Established
Carrot	4	Hoophouse and field	7/13 in hoophouse, 6/16 in field, 6/23 in field (failure)
Beet	3	Field	6/7/14
Cabbage	2	Field	TP 6/10/14
Brussels sprout	2	Field	TP 6/10/14
Rutabaga	2	Field	6/10/14
Parsnip	2	Field	6/10/14
Onion	8	Field	TP 6/7 & 6/12/14
Eggplant	2	Hoophouse	TP 6/14/14
Winter squash	6	Field	TP 6/14/14
Summer squash	4	Field	TP 6/14/14
Turnip	3	Hoophouse and field	6/23 in hoophouse, 7/10 in field
Head lettuce	2	Hoophouse and field	TP 9/29, 10/9, 11/17 in hoophouse, TP 7/29, 8/15 in field
Leaf lettuce	10	Hoophouse	9/9, 9/15, 10/19
Potatoes	4	Field	5/28/14
Kale	2	Hoophouse and field	TP 8/15, 9/9 in hoophouse, 8/3 in field
Cucumber	2	Hoophouse	TP 6/16 in hoophouse
Bok Choi	3	Hoophouse	TP 10/17 in hoophouse
Broccoli	2	Field	TP 6/10 in field
Beet	4	Field	6/7, 6/19, 6/23

TP = Transplanted

Table 2. Variety trial data on vegetable crops grown at the North Farm

Crop	Variety	Total Yield (lb)	Yield (lb)/Bed Ft
Beet	Chioggia	551.69	3.32
	Early Wonder Tall Top	96.9	1.62
	Red Ace	688.34	6.88
	Touchstone Gold	162.28	2.46
Broccoli	Arcadia	110.78	2.22
	Bay Meadows	80.45	1.61
Brussels Sprouts	Churchill	101.1	0.78
	Diablo	63	0.90
Cabbage	Green Hybrid	1330.57	6.65
	Ruby Perfection	684.85	4.03
Carrot	Bolero	275.34	8.34
	Mokum	118.64	2.37
	Nelson	365.17	11.07
	Sugarsnax	485	3.67
Bok Choy	Joi	16.04	2.01
	Red	3.18	0.40
	Win Win	12.82	1.60
Cucumber	Corinto	28.78	0.34
	Tasty Jade	354.06	3.54
Eggplant	Black King	110.88	2.46
	Galine	149.79	3.00
Kale	Lacinato	175.12	2.08
	Red Russian	68.5	3.11
Leaf Lettuce	Flashy Trout Back	17.04	1.70
	Dark Red Lollo Rossa	9.25	0.93
	Lettony	10.07	1.01
	Refugio	2.37	0.24
	Rouge D'Hiver	8.98	0.90
	Ruby Sky	2.3	0.23
	Green Incised	0.8	0.16
	Green Sweet Crisp	1.86	0.37
	Red Incised	0.6	0.12
	Red Sweet Crisp	1.38	0.28
Head Lettuce	Skyphos	22.78	0.69
	Coastal Star	124.1	1.28
*Onion	Ailsa Craig	8	0.18
	Copra	359.32	1.80
	Cortland	75	2.50
	Redwing	273.6	0.86
Parsnip	Javelin	105.09	1.62

	Lancer	113.98	1.75
Potato	Merlot	392.6	2.24
	Norcota	410.78	1.68
	Reba	447.93	2.04
	Spartan Splash	437	1.78
Rutabaga	Helenor	442.02	4.42
	Laurentien	480.48	4.80
Summer Squash	Slick Pik	42.55	2.13
	Y Star	105.86	2.12
	Dunja	244.08	4.88
	Safari	21.91	2.74
Turnip	Hakurei	59.4	0.74
	Scarlet Queen	75.24	1.00
Winter Squash	Blue Hubbard	1282.44	6.41
	Buttercup	671.77	3.61
	**Butternut	65	0.39
	Carnival	457.36	3.18
	Cha Cha	384.09	2.82
	Spaghetti	1351.54	7.27

*Due to curing issues, harvest weights may be inaccurate

**Crop failure