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DEPARTMENT OF AGRICULTURE

Specialty Crop Block Grant Program FY 2013 Final Performance Reports

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Project Title

Growing Potato Starch Under Dryland Conditions in Western Nebraska

Project Summary

Growing potato specifically for the dehydration market is not economically feasible under conventional practices. For dry matter-specific production to be feasible, the input costs need to be reduced (no irrigation, no pesticides, et cetera). Most of the cost of production would be the price of seed potato tubers themselves. Using organic production practices, potato dry matter and starch could be used in organic-based dehydration products. Potato tubers grown as raw material for dehydrated products do not need to be, and usually are not, market quality. Therefore to lower potato seed tuber cost, determining the most economical seed-piece size and spacing of a high-starch cultivar is essential for success. To date, there has not been any completed study of growing potatoes specifically for starch production using sustainable agricultural practices under semi-arid conditions. Western Nebraska is an ideal location for such a study due to its rich soil, dry climate, and low disease and insect pressures. The objective of this study was to produce a high-yielding potato crop with high dry matter under dryland conditions utilizing the principles of sustainable agriculture to keep costs to a minimum. The specific objective was to lower production cost by comparing five plant spacings and five seed-piece weights for high-yield and high-dry matter content using the potato cultivar Atlantic. In preliminary testing of several varieties, Atlantic was found to be the best under these circumstances. This project was the second of a three-year study. The principle reasons motivating growers and industry in this study were to:

1. Establish a consistent source of potato dry matter so that dependency on culls is avoided;

2. Produce raw potato without the use of pesticides; and

3. Provide potato dry matter and starch organic products to consumers.

Project Approach

Data and conclusions from the first year of the project were presented at The Potato Association of America Annual Meeting in Spokane, Washington in July (2014) to over 200 attendees. This information was also presented to the Central Great Plains Working Group in Sidney, Nebraska in August (2014) with 30 attendees from Nebraska and its neighboring states. Since this project is still in the midst of field work, there are no results to report yet.

Seed tubers of the potato cultivar Atlantic were cut into five size/weight classes, 1.5, 2, 2.25, 2.5, and 3 ounces, and allowed to suberize (heal) at 60 to 70 degrees Fahrenheit and acclimate for a few weeks before planting. Planting was in mid-May according to soil temperature. Seed-pieces were planted 6, 9, 12, 15, and 18 inches apart in 36-inch rows at a 4 inch depth using a horizontal-cup planter for precision planting. No pesticides or fertilizers were added. Mechanical cultivation was used twice for weed control and once at the end of the season to aid harvest. Soil samples were taken at the start and conclusion of the season to determine moisture and nitrogen contents. Plants were observed throughout the season for unusual growth patterns.

Tubers were harvested in October to achieve maximum yield and tuber maturity. Yields were weighed and specific gravity determined using a hydrometer after harvest. Dry matter and starch contents can be calculated using an established formula. Plots were two rows, 45 feet long, 36 inches apart. Each seed size by seed spacing plot were replicated 5x in a factorial design, resulting in 25 treatments, five seed sizes, five seed spacings, and 125 total plots. Statistical analysis used SAS software. An economic analysis was conducted at the end of the project, first year of study, to evaluate the economic feasibility of dry matter production in western Nebraska in 2014.

Goals and Outcomes Achieved

The overall goal of this study was to determine the feasibility of growing potatoes under semi-arid conditions using sustainable, organic farming practices in western Nebraska. The following summarizes the results and conclusions following the format listed under Expected Measurable Outcomes section in the project proposal.

Goal #1: The immediate expected outcome was to identify the most economical seed-piece size and spacing to lower the cost of seed potatoes while producing the greatest amount of starch.

There was a significant difference in yield between different seed-piece spacing while there was no significant yield differences based seed-piece weight, i.e., size (Table 1). The highest yields occurred with placing seed-pieces 6 or 9 inches apart. At these spacings, yield was 27% higher than at 12, 15 or 18 inch spacing. Therefore, if highest yield was the goal, then 2 to 3 oz. seed-pieces planted close together would accomplish this. Note that the yields in 2014 were substantially higher (51%). Seasonal rainfall (May, June, July, and August) in 2014 was 73% average or somewhat drier than normal, but in 2013, it was 48% average or very dry. Also, in 2014, the mean temperature for those months was a degree below normal in 2014 (cold), and in 2013, it was a degree above normal (hot). Therefore, the higher yields in 2014 may be due to a more normal rainfall and cooler temperatures compared to 2013 which was very dry and hot.

Table 1. Yield in cwt/acre, 2014.

Seed Spacing (in)	Seed Size in Ounces (oz.)					
	1.5	2.0	2.25	2.5	3.0	Mean
6	155	181	164	176	174	170 A*
9	147	169	156	162	165	160 A
12	126	147	129	148	141	138 B
15	106	141	133	123	141	129 B
18	110	131	123	132	129	123 B
Mean	129 C**	154 A	141 B	148 AB	150 AB	144

* Numbers in column followed by the same capital letter are not significantly different at the 95% confidence level. ** Numbers in row followed by the same capital letter are not significantly different at the 95% confidence level.

Another key tuber characteristic is the amount of dry matter produced. Dry matter content is generally calculated from the tuber specific gravity. Neither seed-piece size nor spacing affected tuber specific gravity (Table 2). The average dry matter content was 24.4% (specific gravity = 1.100). This is considerably higher than last year's average specific gravity of 1.083 (21% dry matter). Note also that last year, there was a slight affect of spacing and size. When calculating the average dry matter production per acre, 3,200 pounds were produced with the wide plant spacings and 4,000 pounds per acre for the narrow spacings.

Table 2. Specific Gravity (1.0xx), 2014

Seed Spacing (in)	Seed Size in Ounces (oz)					
	1.5	2.0	2.25	2.5	3.0	Mean
6	97	102	102	102	99	100
9	98	100	101	101	102	101
12	100	100	97	100	101	100
15	100	100	102	100	102	101
18	97	98	100	98	101	99
Mean	98	100	100	100	101	100

Goal #2: To lower input costs, the starch would be produced using organic requirements, a potential new market could develop, e.g. organic reconstituted chips.

The field project successfully grew potato tubers without the use of any pesticides. Disease and insect infestations did not occur. Weed pressure was minimal and controlled using two early-season mechanical cultivation passes. No fertilizer was applied. Potatoes were planted after dry bean and residual nitrogen was 21 pounds per acre in the top 16 inches of soil. Therefore, practices were such that organic raw material was produced suitable for the organic dry matter market.

Goal #3: Performance of the potato plants will be measured throughout the season using plant growth determinations, weed competitiveness, and tracking production costs.

Emergence was normal, occurring in early June, 17 days after planting. There was no significant difference in emergence between the plant spacing and seed-piece size combinations. Emergence ranged from 64 to 73% (data not shown). Flowering was visually estimated from June to August and showed no significant effect (data not shown). The percentage senescence (vine death) was visually estimated in early October and showed no significant effect (data not shown).

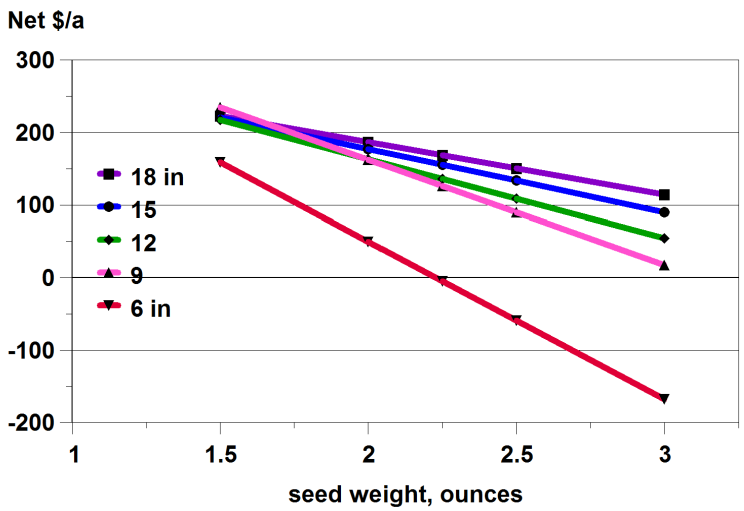
Careful record-keeping of minimal production inputs excluding seed tuber costs were performed. It was estimated that planting cost would be $20/acre, four cultivation passes @ $5 each would be $20/acre, and harvesting cost would be $30/acre. The total operating cost would be $65-70/acre. Note that there was no irrigation cost.

Goal #4: The economic return will be calculated based on market prices paid by

dehydrators.

Seed tuber costs were identified to be up to approximately $11/cwt plus $1/cwt for cutting or a total of $12/cwt. Calculating the amount of potato seed-pieces planted per acre for the various combinations of seed-piece spacing and size, the amount of seed tuber to be purchased ranged from 9.08 cwt/acre (18-inch spacing and 1.5 oz. seed-piece) to 54.45 cwt/acre (6-inch spacing and 3 oz. seed-piece). Therefore, the cost of the seed ranged from $108.96/acre to $653.40/acre. Production cost was the operating cost of $70/acre, which consisted of planting, cultivating and harvesting. Added to the cost this year is shipping from Imperial, Nebraska to Wray, Colorado at $1.70/mile, 75 miles, and a non-refrigerated semi-truck carrying 550 cwt. Total production cost per acre used in calculations is the sum of seed cost (varies with seed-piece size and spacing), operating cost and shipping cost. The range of purchasing over the past few years was $3.50 to $5.50/cwt yield. Note that this was for conventionally-produced harvest and not for organically-produced tubers as the latter market would be new and relatively unknown. To be conservative, the price of $3.00/cwt was used to calculate the gross income per acre based on yield. To identify net income (profit), the total production cost per acre was subtracted from the gross income per acre. Figure 1 shows that return for 2014. The seed spacings that yielded the highest were the least profitable. For the highest profit, spacing further apart and using lighter seed-pieces could achieve the target profits greater than $100/acre (Figure 1). These results are similar to that of 2013.

Figure 1. Net Income based on $ 12/cwt Seed Cost & $ 3.50/cwt Sales, 2014
(note includes shipping from Imperial NE to Wray CO)



Goal #5 The one distinct and measurable outcome external to the project will be the interest and planning of dehydrators.

The economics of producing potato under this scenario was compared to production of dryland millet and wheat for profitability. Table 3 summarizes one comparison based on the yield of planting, 15 inches apart, the size range of 2 to 2.25 oz./seed-piece, 130 cwt/a, sold at the low end of $3.50/cwt. Seed cost at the high end of $12/cwt and shipping cost from Imperial, Nebraska, to Wray, Colorado (75 miles at $1.70/mile) were added to operation costs. Potatoes, when properly sized and spaced at planting, can result in a higher profit to growers than wheat or millet (Table 3).

Table 3. Comparison of Potato to Millet and Wheat, 2014.

Expenses	Millet	Winter Wheat	Potato
operation	$ 75	$ 80	$ 70

seed	$ 7	$ 25	$ 175-195
shipping	-	-	$ 30-45
pesticides	$ 13	$ 30	0
fertilizer	$ 25	$ 60	0
total expenses	$ 120/acre	$ 195/acre	$ 275-310/acre
yield	40 bu/a	40 bu/a	130 cwt/a
price	$ 4.80/bu	$ 6.80/bu	$ 3.50/cwt
gross	$ 190/a	$ 270/a	$ 455/a
net	$ 80/a	$ 75/a	$ 180-145/a

Goal #6 For sufficient information to be accumulated to interest a dehydrator and for scientific dissemination, this project would need to be repeated at least an additional year.

Short reports for this project were published by the Principal Investigator (PI) in 2015. Below are the report details.

Pavlista, Alexander. "Seed Size and Spacing on Profitability for Dry Matter Production in an Organic, Dryland System in Western Nebraska." American Journal of Potato Research. Vol. 92:203.

Pavlista, Alexander. "Growing Potato Profitably for Organic Dry Matter Production in Western Nebraska." HortScience. Vol. 50:S404.

Contact has been on-going with the two dehydration-product companies interested in this study to identify the feasibility of contracting growers for production.

Beneficiaries

The results of this year's project were disseminated to target audiences. His project covered the second year of a three-year study. The target audiences were potato growers, scientists and industry representatives.

A list of presentations given in 2015, to date, in chronological order, were as follows:

1. Organic Farming Conference in February in Torrington, Wyoming. Approximately 65 organic growers in western Nebraska and eastern Wyoming attended.

2. Nebraska Potato Development Conference in March in Kearney, Nebraska. Approximately 20 potato growers attended.

3. Potato Association of America in July in Portland, Maine. Approximately 300 U.S. and Canadian potato growers, University personnel, USDA-ARS representatives,

and Ag-Canada researchers were in attendance.

4. American Society of Horticultural Science in August in New Orleans, Louisiana. Approximately 100 U.S. horticultural growers and scientists attended.

5. Central Great Plains Working Group in August in Akron, Colorado. Approximately 50 people attended, which consisted of USDA-ARS researchers and Extension specialists from University of Nebraska – Lincoln, Colorado State University, Kansas State University, University of Wyoming, and South Dakota State University.

6. Preliminary findings were published in the *American Journal of Potato Research* and in HortScience, as referenced above.

Plans already set for 2016 include presentations to:

1. Western Nebraska Sustainable Ag Crops and Livestock in December 2015 in Ogallala, Nebraska. It is estimated that 100 people will attend.

2. The Potato Association of America Annual Meeting in July in Grand Rapids, Michigan. It is estimated that 300 people will attend.

3. Central Great Plains Working Group in August in Hays, Kansas. It is estimated that 50 people will attend.

Long-term plans for dissemination of the results of the study are as follows:

1. Publish the results on the Internet. It will be uploaded to UNL's Potato Education Guide website (http://cropwatch.unl.edu/potato-education-guide) under the Potato Research section (http://cropwatch.unl.edu/potato/potato_research).

2. A manuscript of the project will be submitted to the *American Journal of Potato Research* and to the Potato Associated of America. Combined, it is estimated this information will reach 1,000 industry representatives.

3. A UNL Extension publication is planned to be written in 2016-17 on the cost of growing potatoes for the dehydration industry.

4. Presentations will be made to approximately 2 – 4 dehydration corporations who have interest in dry matter/starch production and organic dry matter products for consumers.

Lessons Learned

The two primary outcomes for this year, which also verified last year's results, were as follows:

1. The seed-piece size and spacing combinations resulting in the highest yield were the least profitable.

2. Growing dryland potatoes organically can be at least as profitable as growing

winter wheat or millet in western Nebraska.

The recommendation from the two completed years of this study may be more strongly formulated. For profitability greater than $100/acre, plant seed-pieces 2 to 2.25 oz. in weight and space them 15 to 18 inches apart. These parameters would result in planting between 12 and 16 cwt/acre and a population density ranging between 9,700 to 11,600 plants/acre.

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Project Title

Agronomic Practices for Fenugreek in Western Nebraska

Project Summary

Fenugreek is an annual legume of which 75% is grown in India. It is an important medicinal crop with properties alleviating many conditions such as Type 2 diabetes and inadequate lactation in nursing mothers. Fenugreek is not grown in the Western Hemisphere. Can western Nebraska take the lead and become a source of fenugreek products in North America? There is no information on this possibility. Therefore, the overall objective to accomplish this was to identify several key production parameters for western Nebraska. The specific objectives of this study were to identify the amount of irrigation needed, the best planting date in the spring, and the timing of harvest for optimal seed yield. Western Nebraska is an ideal location for this study due to its similarities to the fenugreek growing province of Rajasthan, India. Similarities include a dry, well-drained sandy loam soil that is slightly alkaline and highly calcareous. Annual rainfall and seasonal temperature is similar to western Nebraska. The benefit is to introduce a new crop and new industry into western Nebraska and entice interest from pharmaceutical companies to consider Nebraska as a source of raw product.

Project Approach

Seed of the Canadian forage cultivars Amber and Tristan were planted alongside on May 6, 20 and June 6, 2014. Preliminary trials demonstrated that planting in April was too soon. Plot sections for each planting date were harvested at three different times, August 19, September 10 and October 2, 2014. The growing-season variable was irrigation. Three regimes were instituted, which included no irrigation, half irrigation (or 0.5 inch per week), and full irrigation (or 1 inch per week). Total irrigation from early June to early September was 0, 5 and 11½ inches.

When rainfall was added into the calculation, total water exposure ranged 3½ to 12 inches, 4 to 16 inches and 4 to 12 inches for each harvest, respectively. No nitrogen was added since the preliminary trial data indicated that sufficient nitrogen (30-40 pounds/acre) was in the soil. Plants were sown in 12-inch rows at a seeding rate of 18 pounds/acre resulting in a density of 13,000 plants per acre or 3 to 4 plants per square foot. A separate trial in 2014 indicated that this was the optimal seeding rate. Plots were placed in a 3x3 Latin square design with irrigation level as the main plot. These were split into three planting dates and each of these sub-plots were split between the two cultivars. This allowed all parameters to be statistically compared using SAS software.

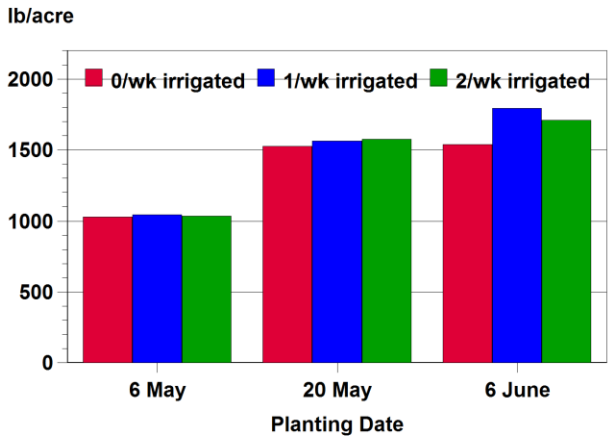
Goals and Outcomes Achieved

The overall goal of this study was to develop the technology and determine the feasibility of growing fenugreek under the semi-arid conditions of western Nebraska. Three measurable agronomic outcomes for determination are planting date, irrigation level and harvest date. The following summarizes the results and conclusions following the format listed under the Expected Measurable Outcomes section in the project proposal.

Goal #1: Irrigation requirements for optimal fenugreek production.

Yield was not affected by the amount of irrigation, regardless of the planting date (Figure 1). Since applied water (rain + irrigation) in July and Aug. was similar in both years, the difference may be rainfall during planting in May. Records form the High Plains Climate Center showed that in 2013, rainfall from May 5 to June 5 was 1.4 inches while in 2014, rainfall was 3.7 inches. The year 2013 is considered to be a very dry year and irrigation began on June 10 shortly after the last planting. On the other hand, 2014 had a significantly higher rainfall in the spring compared to the previous year, and therefore, irrigation did not begin until July 3, a month after the last planting. Tentatively, this comparison suggests that if there is considerable early rains in May, irrigation may be able to be reduced and a planting date is a more important factor. Another comparison of the years is that the seasonal temperature in 2013 was a degree above normal or hot, and in 2014, the temperature was a degree below normal or cold. This may have played a role as well.

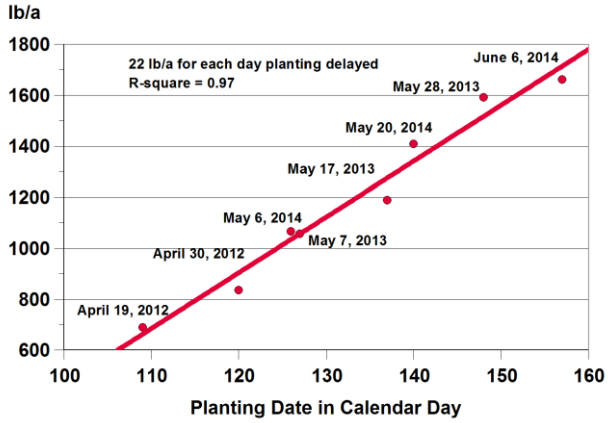
Figure 1. Amber Seed Yield Harvested in early-mid Sep, 2014



Goal #2: Appropriate spring planting dates for seed production.

Combining data from 2012, 2013 and 2014 under full irrigation and harvested in mid-September, a linear relationship appears between planting and yield (Figure 2). The graph suggests that planting on June 6, seed yield still may not have reached maximum. From April 19 to June 6, for every day delayed in planting, there was a significant (R^2=0.97) increase in yield by 22 pounds/acre. From this information, planting was further delayed in 2015.

Figure 2. Yields (in Sep) by Planting Date, Full Irrigation



Goal #3: Appropriate late summer/early autumn harvest dates.

Harvesting date showed an effect on seed yield with the optimal period being early September (Figures 3 and 4). A planting date versus harvesting date interaction was identified with later planting showing the highest yield at all three harvest dates. This year's data confirms last year's in that harvesting in the first half of Sep. achieved the greatest yields and allowed greater flexibility in planting between mid-May and early June regardless of the irrigation level.

Figure 3. Fenugreek Harvest Yield, full irrigation, 2014

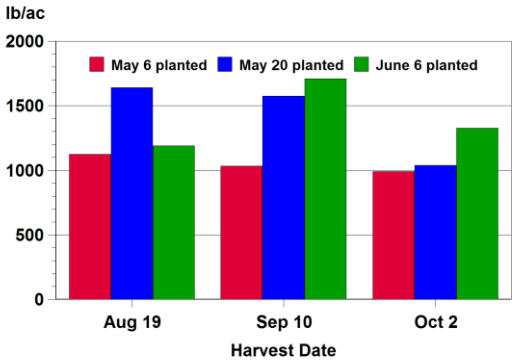
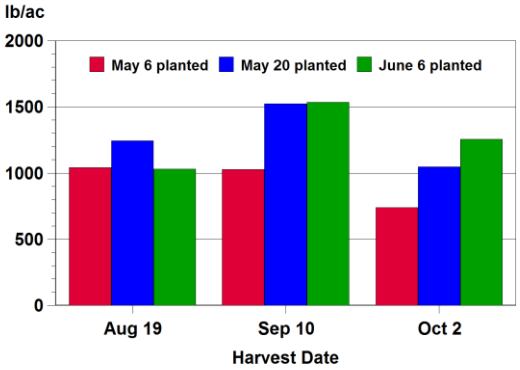


Figure 4. Fenugreek Harvest Yield, no irrigation, 2014



Goal #4: Growth patterns will be measured throughout the season as a guide for future growers.

As reported in last year's Annual Report, growth patterns (height, weight, flowering, and fruiting) were affected by planting date, irrigation level and harvest date. Full irrigation promoted growth and planting date affected reproductive timing.

Goal #5: The principle measurable outcome over time will be the adoption of fenugreek into the production system of western Nebraska.

This is a long-term goal. By accumulating good production data and presenting this information to growers and industry, this goal could be fulfilled.

Goal #6: The one distinct and measurable outcome external to the project will be the collaboration between the University of Nebraska Medical Center partnering with the University of Nebraska Institute of Agriculture and Natural Resources. One supported the agronomic facets and the other supported the pharmaceutical aspects.

Contact has been on-going with the University of Nebraska Food Science Department and Food Processing Lab. Interaction with the University of Nebraska Medical Center has started through the "Food for Health" program. Through separate grants to Drs. Santra and Su, genetic lines will be analyzed for medicinal compounds and adaptation to western Nebraska.

Goal #7: For sufficient information to be accumulated to interest the pharmaceutical industry and for scientific dissemination, this project needs to be repeated for three years."

This project was the second year of a three year fenugreek study. Early results were presented and published by Alex Pavlista and Dipak Santra. A document entitled, "Seed Yield of Fenugreek in response to Planting Date, Irrigation, and Harvest Time" was published in *HortScience* Vol. 50:S134.

Beneficiaries

The results of this year's project were disseminated to target audiences. This project covered the second year of a three-year study. The target audiences are growers and scientists.

A list of presentations in the second year (2014-2015) of this study were as follows:

1. New Crops Conference in December 2014 in Sidney, Nebraska. Approximately 50 growers attended.

2. American Society of Horticultural Science in August in New Orleans, Louisiana. Approximately 100 US horticultural growers and scientists attended.

3. Central Great Plains Working Group in August in Akron, Colorado. Approximately 50 people attended, which consisted of USDA-ARS researchers and Extension specialists from University of Nebraska – Lincoln, Colorado State University, Kansas State University, University of Wyoming, and South Dakota State University.

4. High Plains Ag Lab Field Day in August in Sidney, Nebraska. Approximately 150 growers attended.

5. Preliminary findings were published in *HortScience*, as referenced above.

Plans already set for 2016 to include presentations to the following:

1. Western Nebraska Sustainable Ag Crops and Livestock in December 2015 in Ogallala, Nebraska. It is estimated that 100 people will attend.

2. Central Great Plains Working Group in August in Hays, Kansas. It is estimated that 50 people will attend.

3. High Plains Ag Lab Field Day in August in Sidney, Nebraska. It is estimated that 150 growers will attend.

Long-term plans for dissemination at the study's conclusion are as follows:

1. Publish the results on the Internet. A new web-site specifically for fenugreek will be developed in 2016-2017.

2. A manuscript of the project will be submitted to the *Journal for Medicinal and Aromatic Crops.* This document will be prepared in 2016 and is estimated to reach approximately 1,000 industry representatives.

3. A UNL Extension publication is planned to be written in 2016-17.

Lessons Learned

The most interesting outcome was that there was significant interaction between planting and harvest dates, and the possibility that fenugreek might be able to be grown without irrigation if

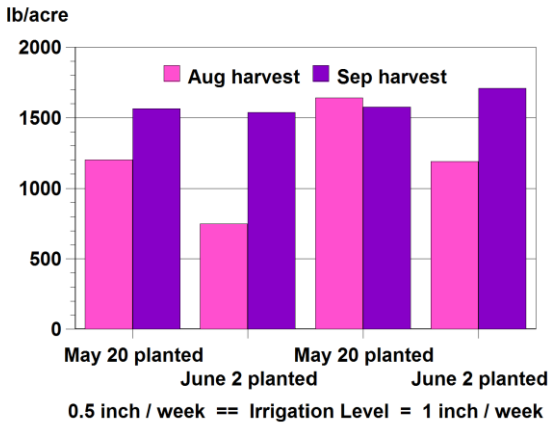
there is sufficient rainfall before planting. From the second year's results, yields greater than 1,500 pounds/acre were achieved at the September harvest with both 0.5 and 1 inch irrigation per week (i.e., irrigated once or twice per week, regardless of planting in mid-May or early June (Figure 5)). At the earlier August harvest (planted in mid-May), yield above 1,500 pounds/acre was achieved only with full irrigation (1 inch/week). The resulting tentative recommendations from this year, requiring verification from the 2015 season, were as follows:

1. If irrigation is not limited (1 inch/week) and harvest is planned for late August, then planting should be in mid-May. If harvest is planned for September, then planting may be from mid-May to early June. This agrees with the 2013 recommendation.

2. If irrigation is limited (0.5 inch/week), planting should be in mid-May and harvest may be from late August to early September.

3. Yield was the lowest when harvest was in early October.

Figure 5. Amber Seed Yield, 2014



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Project Title

Nebraska Farmers Market Online Database

Project Summary

The Nebraska Department of Agriculture (NDA) utilized SCBGP funds to establish an online, interactive, farmers market database that is easy to use for both consumers and produce growers alike. This system is designed to enable consumers and market managers to locate and contact produce growers, streamline the vendor certification process for NDA's Senior Farmers Market Nutrition Program (SFMNP) and Women, Infants, and Children Farmers Market Nutrition Program (WIC FMNP), and improve program efficiencies. It is intended to be a reliable and functional web-based database that improves the connection between buyers and sellers and decrease the workload of NDA trying to keep profile records up-to-date and maintain vendor program performance, thus saving time and money. This database has been established to make it easier for consumers to find local produce vendors and markets, enable growers to establish a larger customer base, serve as a catalyst for attracting market patrons, and increase the purchases of specialty crops. Increasing farm profitability aids in creating robust communities, which is becoming increasingly important in small-town America.

Project Approach

NDA houses a database that consists of over 600 active produce growers, many of whom are enrolled in the Senior Farmers Market Nutrition Program (SFMNP) and Women, Infants, and Children Farmers Market Nutrition Program (WIC FMNP). The list of growers was found on NDA's webpage allowing consumers to locate produce growers. Growers were grouped into counties and each vendor profile included the grower's name, address, city, state, zip code, phone number, county, and (if available), fax number, e-mail, and company web site. It also listed the products they sell and the outlets through which they sell such as farmers markets, roadside stands u-pick operations and/or Community Supported Agriculture operations (CSAs). NDA received numerous hits to this map and fielded several phone calls each year helping consumers find local produce growers and markets. Unfortunately, with such a large database, keeping each profile record up-to-date was extremely difficult and labor intensive as each profile has to be key-entered into the database and then transferred to the website by NDA personnel. A significant amount of time and labor was spent checking and correcting profiles every year. In an effort to streamline this process, NDA utilized grant funds to establish a web-enabled system that would store this produce vendor information. Vendors are provided with individual user-names and passwords so they can control their own profile information and update it as often as they choose.

Secondly, while the demand for local produce remains stout throughout Nebraska, the ability for consumers to find local vendors and markets was problematic. With the increasing popularity of mobile devices and app software, NDA believed that development of an electronic, web-based system will play a large role in overcoming this barrier. It would allow smart phone users the ability to find nearby markets and produce growers. Once a desired market or vendor has been located, users could view the vendor or market's profile information, and the months, days of the week, and hours the produce stand or market is open.

Consequently, a new software platform was developed to store vendor information. It has several benefits. It makes it easier for consumers and market managers to locate and contact

produce growers, streamlines the vendor certification process for NDA's SFMNP and WIC FMNP, improves the connection between buyers and sellers, improves program efficiencies, and saves time and money. This web system will potentially increase vendor foot traffic at local stands and markets, thus increasing farm profitability and rural and economic sustainability.

NDA anticipated that it would take up to three years to develop this user-friendly, fully functional web-enabled database system. However, once the contractor had been identified, it was discovered that this project would be completed by the Spring of 2015.

Goals and Outcomes Achieved

Expected Measurable Outcome #1: Identify a firm who is able to develop the database.

The first goal was to identify a firm who was able to create an online database that was custom-fitted to NDA's specifications. No benchmark existed. The target was set to identify a Lincoln, Nebraska-based company who had been approved to conduct business with the State of Nebraska (via the State of Nebraska's State Purchasing Bureau). NDA was required to first attempt to identify a company who had been approved to conduct business with the State of Nebraska who could perform this work. If unsuccessful in this search, NDA could solicit bids from outside firms via a Request for Proposal Process (RFP). Due to the complexity and uniqueness of this project, the pool of available and qualified contractors was limited. Thankfully, NDA did not have difficulty identifying a State of Nebraska bid-approved company to perform such work. As a result, the solicitation of bids from outside firms and the detailed process involved via an RFP process was not warranted. This shortened the time-frame needed to complete the project.

Nebraska Interactive, LLC was the company identified and selected to develop the database. They had the knowledge and ability to develop a software platform that would encompass all of the requirements needed per NDA's instruction. An estimated number of hours, cost per hour, total costs, and projected timeline for creation of the database was predetermined and agreed upon. Working with NDA on a part-time contractual basis, the company agreed to meet all of the specifications as outlined by NDA. The initial request from Nebraska Interactive stated that approximately 398 hours with a project cost of $49,750 would be needed to create this database. This contracted amount was mutually agreed to upon by both parties via a written agreement signed on October 28, 2013. NDA had budgeted up to $52,000 in SCBGP funds to pay for contractual expenses associated with this project. This amount was to pay for project management, function analysis, prototyping, development, and testing based on NDA requirements. The self-funded model provided the flexibility to absorb, within reason, cost overages encountered during the project. The annual maintenance and hosting costs were covered by the contractor's self-funded model. Changes to the application's post launch were analyzed before determining if they could be absorbed into the model.

This goal was measured by determining if a Lincoln, Nebraska-based company could be identified and able to fully complete the work in a timely and affordable manner or if an RFP process was needed. Nebraska Interactive is a Lincoln, Nebraska-based company that was selected to complete the work. An RFP process was not necessary. This goal was achieved.

Expected Measurable Outcome #2: Develop program preferences, implement security measures, and incorporate administrative controls in order to make the database user-friendly for consumers, produce vendors, and NDA personnel.

The second goal was to develop program preferences, implement security measures, and incorporate administrative controls to ensure that the database was user-friendly for consumers, vendors, and NDA personnel. No benchmark existed. This goal was expected to be completed by the Summer of 2015 (target). It was achieved in the Fall of 2014. During the development phase, NDA worked with the selected firm to identify all of the necessary vendor program fields and requirements that were needed to store vendor information. The system will keep detailed individual vendor profile records including name, address, city, state, zip code, county, phone, and (if available) fax, e-mail, web site, outlets through which produce is sold (including the names and locations of Nebraska farmers markets, roadside stands, and / or CSAs), and products sold. The system has several specific functions that are detailed in a document written by Nebraska Interactive. From the functional side of this program, this system is able to:

- Transfer existing data from NDA's FMNP database into the new software;
- Enable the public to locate vendors and markets by filtering a report;
- Create a Farmers Market Nutrition Program (FMNP) online vendor application process that includes required fields and drop down menus;
- Send automated reminders to vendors who need to certify and/or recertify;
- Develop management systems for NDA staff to trace vendor qualification requirements for participation in the FMNPs;
- Store individual vendor compliance records and violations;
- Allow certified vendors to review and update their information as needed;
- Enable NDA to provide data validation;
- Implement controls to avoid duplication of data;
- Provide vendors with individual user names and passwords;
- Implement controls to protect all data;
- Allow NDA staff to administer all data prior to inclusion in any publicly available output; and
- Provide NDA staff with full administrative responsibilities to control vendor listings.

It was initially decided that by the time the software had been developed and the information was successfully transferred from NDA's existing database to the new system, NDA would assemble a five member review team that would consist of, at a minimum, a consumer, a specialty crop producer, and NDA personnel. They would take a firsthand look at the newly developed program and would be provided with score sheets with which to rank the software's functionality as they navigated through the system. Score sheets would be returned to NDA and carefully reviewed. Recommendations on the score sheets would be shared with the software company to see if the issues could be addressed to make the program more user-friendly. The success of this goal would be measured by how well the system scored based upon the returned score sheets (performance measure).

These steps were achieved, but occurred earlier than anticipated. In the Summer of 2014, Nebraska Interactive informed NDA that the platform was established. If any adjustments or changes to the system were to be made, they needed to be done during the earlier stages rather than when the system was ready for Internet launch. Therefore, NDA quickly assembled the review team.

In an effort to represent a broader audience and to involve other agricultural interests, NDA altered the number of review team members from five to 11. The review team met on July 29,

2014, in Lincoln, Nebraska, to evaluate the prototype. The team included two produce growers, one honey producer, one apple grower, one farmers market manager, and six NDA staff members. The six NDA employees consisted of the Public Information Officer, Assistant Director, Graphic Designer, Beginning Farmer Mediation and NextGen Program Manager, and two Ag Promotion Coordinators. The meeting generated a lively discussion that lasted a couple of hours. Comments between the reviewers and Nebraska Interactive were shared, which proved to be very beneficial. New ideas and suggested changes were recorded by NDA and shared with Nebraska Interactive to improve the functionality and makeup of the database.

Score sheets were handed out to every team member. It contained 13 questions that were scored on a rating scale of 1 (Strongly Disagree) to 4 (Strongly Agree). The highest score to attain was 52 with the lowest being 13. When the meeting concluded, scores sheets were collected, reviewed, and tabulated. A few of the scores sheets returned did not rank every question and one form had extremely low marks to all questions. Unfortunately, this form had very few written comments for project improvements. Below is a copy of the score sheet.

NEBRASKA FARMERS MARKET ONLINE DATABASE
SCORE SHEET

		Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
1	It was easy to use this system.	1	2	3	4
2	The tasks and scenarios were able to be completed quickly.	1	2	3	4
3	I felt comfortable using this system.	1	2	3	4
4	I believe this website could improve my business or organization.	1	2	3	4
5	The search functions were easy to use.	1	2	3	4
6	The information provided was clear.	1	2	3	4
7	It was easy to find the information I needed.	1	2	3	4
8	The information was easily identified when tasks and scenarios were demonstrated.	1	2	3	4
9	The organization of the system was clear.	1	2	3	4
10	This system has all of the functions and capabilities I would expect it to have.	1	2	3	4
11	I liked the general appearance of the website.	1	2	3	4
12	I will use this website.	1	2	3	4
13	Overall, I am satisfied with this system.	1	2	3	4

Total Points	

Recommendations for Improvement.

Expected Measurable Outcome #3: Set a launch date to upload database onto the web.

Once the new database was completed, vendor information was uploaded to the database. NDA worked with the software company to set a system launch date to the Internet. This was the third goal of the project. No benchmark existed. The target was to have the database accessible via the web by the Summer of 2015. The success of this goal was to be measured as to when the database is accessible via the web (performance measure). Due to the substantial amount of progress Nebraska Interactive made in creation of this database in 2014, the system was uploaded to the Internet on March 4, 2015.

The Farmers Market Online Database consists of 103 farmers markets and over 600 Nebraska produce growers. There are three prongs to this site – public, vendor, and administrative. Below is a link to each side of the database.

Admin:
https://www.nebraska.gov/apps-ag-farmers-market/admin/index

Vendor:
http://ne.gov/go/producevendor

Public:
http://ne.gov/go/neproduce

NDA hosted an educational session on March 16th to enable NDA staff to become familiar with this system. Nebraska Interactive co-hosted the training with NDA. As NDA transitioned to this new system, there were a high volume of calls from vendors who had difficulty navigating through the system.

On April 22, 2015, NDA sent out a news release to the media announcing the rollout of the new Nebraska Farmers Market Online Database (http://www.nda.nebraska.gov/press/april2015/market.pdf). This announcement attracted a lot of interest, and it was published in the following media publications:

http://www.kotatv.com/news/nebraska-news/ne-customers-producers-have-new-online-farmers-market-guide/32597814
http://journalstar.com/business/agriculture/new-farmers-market-database-available/article_e0268202-3154-5eef-87c8-d46ef0145795.html?print=true&cid=print

http://www.kearneyhub.com/news/find-local-produce-with-new-nebraska-farmers-market-online-database/article_cf73961e-e9d8-11e4-b983-739cbe3c06a7.html

http://www.nebgrocery.com/wp-content/uploads/2015/08/NGIA-2015MarApr.pdf (pg. 13)

This goal was achieved.

Expected Measurable Outcome #4: Encourage Nebraska produce growers to log on to the database to enter, update, or verify their vendor information.

The fourth goal of this project was to encourage Nebraska produce vendors to log onto the online database and enter, update, or verify their information. No benchmark existed. The target was set to have 500 growers log on to the database and enter their profile information by September 2016. The success of this goal was to be measured by how many grower profiles entered, updated, and / or verified by September 2016 (performance measure).

Letters and emails were sent to 680 produce growers in March 2015 encouraging them to log on to the new database to access their profile and update their information. NDA assigned a specific user name and password for each vendor. Vendor profile information included name, address, city, state, zip code, county, phone, and (if available) fax, e-mail, web site, outlets through which produce is sold (including the names and locations of Nebraska farmers markets, roadside stands, and / or CSAs), and products sold. For vendors who needed to certify or recertify for the FMNPs, they were given onscreen instructions to complete their certification steps. A total of 266 vendors updated their profile from March 16 to September 30, 2015.

To "kickoff" National Farmers Market Week, NDA sent out a news release announcing that it had registered its 100th farmers market in the state (http://www.nda.nebraska.gov/press/july2015/farmermarket.pdf). The new website was touted in this announcement. This news article was published in the *Farm Progress* Magazine (http://farmprogress.com/story-nebraska-marks-national-farmers-market-week-100-market-milestone-9-130324) and a local TV station interviewed NDA's Ag Promotion Coordinator promoting this website and Nebraska's farmers markets. NDA was interviewed twice in 2015 around the time of National Farmers Market Week (late July/early August). The television segments can be found at https://www.youtube.com/watch?v=8cMGBQS5xmE&feature=youtu.be&a and http://www.1011now.com/video?videoid=3230548.

This goal was achieved.

Beneficiaries

This project will impact a wide variety of people.

Approximately 680 Nebraska produce growers involved in the growing and selling of specialty crops are beneficiaries of this project. It is a consumer-friendly, reliable, electronic database that will serve as a catalyst for attracting market patrons, and it will increase the purchases of specialty crops. It will improve the connection between buyers and sellers and will potentially increase foot traffic to farmers markets, roadside stands, u-pick operations, and CSAs.

Specialty crop consumers will also be beneficiaries of this project. Online directories have become an increasingly popular method of marketing. As a result, consumers, especially those who are tech-savvy and frequently use smart phones, will find this database especially helpful and informative. It will enable them to find easy access to fresh, nutritious locally grown produce. Once a consumer locates a grower or market, he/she will be able to view the vendor or market manager's contact information, and the months, days of the week, and hours the vendor stand or market is open. Consumers will have access to vendor grower names, addresses, cities, states, zip codes, phone numbers, and (if available), fax numbers, e-mails, and company web sites. They will also be able to view the products they sell and the outlets through which they sell. The more consumers who frequent the database and visit nearby vendor stands and/or markets, the more likely growers are able to experience a larger customer base and higher profit margins.

NDA will also be a beneficiary of this project. It has improved electronic access to program and grower information, streamlined the SFMNP and WIC FMNP vendor certification process, and reduced NDA's time and work associated with management of these programs. NDA has utilized the software platform for administrative purposes to record and maintain detailed individual records for specialty crop growers. It has enabled NDA to have the authority to monitor, access, and control vendor listings, and controls any other output so that personal grower-sensitive information is not available to the public.

Lessons Learned

As stated above, a team to review the database occurred much earlier than anticipated. Nebraska Interactive informed NDA that once the platform had been established, changes would need to be made then rather than when the system was ready for Internet launch. This was somewhat problematic as NDA had to quickly assemble a diverse specialty crop review team that consisted of representatives who had interests and stake in the specialty crop industry.

Secondly, the review team had to meet in Lincoln in late July, a time that was the peak harvest season for Nebraska specialty crop producers. In an effort to represent a broader audience and to involve other agricultural interests, NDA altered the number of review team members from five to 11.

Last, NDA spent a significant amount of time paring down their database by removing vendors who were no longer were in the business of selling specialty crops. Only vendors who were in NDA's database from 2010 to present day were uploaded to the new website.

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Project Title

Farm to School – Increasing Childhood Consumption of Fruits and Vegetables

Project Summary

The primary purpose of our Farm to School project was to develop and hold a statewide Farm to School Summit that engaged stakeholders from across the Farm to School board, educating and connecting specialty crop growers, school staff and food service professionals, students and community members. The Summit worked to increase knowledge on farm to school best practices, as well as the benefits to all stakeholders when engaging the program. When farm to school is engaged, additional markets can be opened for specialty crop growers and healthy food options for Nebraska students can become more available. The Summit provided education, knowledge, orientation, direction and inspiration for schools and growers to engage farm to school or increase their involvement, thus expanding markets for specialty crop growers. This project was well timed, rolling off of lessons learned and momentum garnered from a pilot Summit held in 2012. Nebraska had lagged behind as one of only a few states that had not embraced farm to school.

Project Approach

The Center for Rural Affairs first assembled an Advisory Committee in Fall of 2013 that included school and food producer representatives. This included project partners including specialty crop producers, food service directors, the Nebraska Department of Education, Buy Fresh Buy Local Nebraska, the Nebraska Farmers Market Association, Nebraska Sustainable Ag Society, Nebraska Farmers Union, and a representative of the Nebraska Unicameral Legislature. We met via conference call, as needed, and communicated often via email to determine Summit details such as conference location, content, presentation materials, speakers, and promotion of the Summit. The Center for Rural Affairs project leader connected one-on-one with various advisory members, as needed, depending on the expertise and input required. Additionally, these project partners were able to share information about their organizations in our exhibit hall, and promote the support they are able to offer to stakeholders interested in a farm to school project.

Goals and Outcomes Achieved

The Summit was held at The Leadership Center in Aurora, Nebraska on October 22, 2014, from 9 a.m. – 4 p.m. The venue was secured in April 2014 and was a central location for the statewide conference. Space was more than adequate, including a large gymnasium dedicated to exhibitors, a large space with a beautiful view that served as our primary full group session space, and ample breakout rooms for each session. The Leadership Center chef was enthusiastic and willing to procure local food and highlight local growers. Local items were sourced for breakfast, snack, and lunch. Posters were displayed throughout the dining area and they listed what local items were being provided. Meals were provided to all attendees, and this expense was charged to the grant. There was insufficient time available to allow participants to find food on their own without disrupting the continuity of the conference.

The Summit included 17 presenters, 13 panelists, 3 facilitators, and 17 exhibitors. We began with a keynote address from Nebraska State Senator Rick Kolowski, who is working to bring local food production to the forefront of Nebraska. Following the keynote, we offered five sessions. They were as follows:

Impacting Policy Changes on a State Level (Anna Wishart, Legislative Aide);
Using a Forward Contract for Local Purchasing (Robert Gorman, USDA Farm to School);

Implementing Farm to School into School Wellness Policies (Zainab Rida, NDE Team Nutrition;

FSMA and GAPs (Elizabeth Killinger, UNL Extension); and

Using Aquaponics in the Classroom (Greg Fripp, Whispering Roots).

Before lunch, all participants gathered for a "Lightning Round" session where 10 speakers addressed farm to school from their perspective. Among these speakers was a Lincoln Public Schools 9th grader who shared her story of sourcing an entirely local foods lunch and how and why she went about the project. She ended her five minute presentation with a quote from Michael Pollan, "Shake the hand that feeds you." As the student sat down to a warm applause, the moderator asked the audience to please raise their hand if they were a food producer. More than fifty hands were raised and the applause in the room was momentous. Additional Lightning Round presenters included the owner/operator of a local mushroom operation, a food producer who also does minimal processing in his USDA certified facility, a Wellness Coordinator who talked about sourcing local foods for her Healthy Chefs Night with students, and an organization that touched on the positive health factors that come from practicing farm to school,.

During lunch, we heard from Bryce Abbey, who is an Assistant Professor of Exercise Science at the University of Nebraska at Kearney. He talked about the need for embracing healthier lunches at schools. His presentation, *Living a Wellness Life*, scored 4.1 out of 5 from the attendees who attended the Summit. Mr. Abbey brought increased awareness for the need for healthier school food options, as demonstrated from comments shared on the evaluations.

Lunch was a celebration of local foods, highlighting several local producers. At the end of the Summit, the crowd was asked what their favorite food item throughout the day was, and there was a resounding answer of "Lunch!" A few highlights included roasted carrots from Pekarek's Produce from Dwight, NE, Jisa's cheese out of Brainard, NE, and Grain Place Grains out of Marquette, NE. Those producers in attendance were able to stand and gain recognition for their products.

After lunch, another breakout session was held, this time for each of the three primary stakeholder groups, which were food producers, food service professionals, and community members/school staff or students. These breakouts featured expert facilitators and panelists. In the food producer and food service professional breakouts, panelists included food producers who have sold or are selling to schools and food service directors who purchase from local food producers. A representative from UNL Extension also addressed questions for food producers regarding farm food safety issues and opportunities. The panel for the community session consisted of a past school nurse/current food service director who sources products locally, a student who has been involved in farm to school in the past, a dietician who works on farm to school promotion, and a teacher responsible for her school's garden and garden curriculum development.

We heard abundant positive feedback about this session. Examples included, “Crucial knowledge gained by hearing actual food service directors! Great!” and “Lots of formal and informal comments and questions - very informative.”
After a break to taste test of Nebraska popcorn, local apple cider, and pumpkin bars, the group was divided regionally into two groups where they met in concentric circles. The inner circle consisted of food producers and the outer of school representatives. The purpose of this activity was to provide organized networking and build potential purchasing relationships. When asked, “Did you meet someone you may sell to or purchase from in the future as a result of this session?”, 9 food producers said “yes”, 5 said “maybe”, and 0 responded “no”; likewise, 11 schools said “yes”, 3 said “maybe”, and 0 said “no”.

When asked, “How do you rate the Summit overall?”, the rating was 4.6 out of 5 with 39 total responses. And when asked, “Because of this experience, are you more likely to pursue Farm to School activities in the future?”, 74% said “yes, definitely” and 26% said “yes, probably”, with a total of 37 responses. No one responded “No”.

Outreach for the Summit was crucial and included help from partner organizations. Over the course of several weeks and sending multiple emails, we reached out to school food service directors and administrators inviting them to attend. The Nebraska Sustainable Ag Society listserv was used to share the Summit information and to reach numerous food producers. Buy Fresh Buy Local Nebraska and the Nebraska Food Cooperative shared the announcement within their networks. The Center for Rural Affairs distributed the information to their Nebraska contacts, website (www.cfra.org/farm-to-school), Facebook page, and Twitter feed. It was also posted on the Nebraska Farm to School Facebook page and Twitter feed. Additionally, multiple media releases were sent to statewide news organizations. A poster was created and distributed widely and postcards were sent to over 700 Nebraska contacts.

The Summit was attended by a total of 114 people, representing a total of 21 schools. Six of these schools represented urban populations or school districts of 5,000+ students, and 15 of the schools were from rural districts with student populations ranging from 107 to 2,186 (K-12). The total number of students that will be reached from the districts that attended the Summit is 112,904. Of this number, 9,791 of these students are from rural districts and 103,113 are from urban or districts greater than 5,000 students. Of the 114 registrants, 51 identified themselves as food producers or representing food producers.

Our goal was to expand new markets for specialty crop growers by building farm to school awareness and practices within 25 schools. Twenty-one schools attended the Summit. Many received personal invitations to attend or they heard about the Summit through media outlets like Facebook and partner organization promotions. Because of the statewide reach of the Summit, interest far exceeded the number of schools who were able to attend. States within the Midwest region are reaching out to us as experts, requesting advice and guidance in planning conferences of this in the future. We will be gauging supply of specialty crops to these schools with follow up surveys 6 weeks post-Summit, and again in the Spring. We will continue to follow-up statewide with schools who contact us for Farm to School support.

<u>September 30, 2014 – September 29, 2015</u>
Six weeks after our Statewide Farm to School Summit, we electronically surveyed participants. 9 food producers, 13 food service professionals, 8 community members and 4 faculty members responded to this survey. Eleven of those food service professionals had made contact with a food producer and 7 had already purchased local foods from a producer. On a 3 point scale,

2.72 average rating (91%) was given for the question, “I gained better knowledge so that I could take actions toward local food purchasing/selling and/or building farm to school teams and/or school gardens.” On a 3 point scale, 2.41 (80%) said that they made a connection with a producer/school that will be lasting. A combined total of 2.83 on a 3 point scale (94%) said they received good resources as a result of attending the Summit, and 2.42 of 3 (81%) said they are able to build a community or team who will champion farm to school efforts. Eighty-four percent said they will likely attend another Farm to School Statewide Summit, if it is offered again.

We’ve continued to support these relationships with information sharing through our monthly farm to school newsletters. We also were able to reach out to many attendees to participate in a regional farm to school gathering we held in Beatrice in March 2015. These participants networked with each other, participated on panels, and led sessions at this conference. Some also were able to exhibit and share information on their business, organization and/or farm.

September 30, 2015 – September 29, 2016

In this project period, we offered farm to school programming and two webinars for farmers. We shared best practices, profiles of successful farm to school relationships, training opportunities and funding options with 500 Nebraska farm to school e-newsletter subscribers. Those who have attended farm to school conferences or trainings with the Center for Rural Affairs received these newsletters and are able to stay in touch with us on an as needed basis. Summit attendees have received all updates and opportunities on a continuing basis.

Partners that were developed because of the Summit have grown in their farm to school efforts. The Nebraska Department of Education-Nutrition Services (NDE-NS) took an active role in execution of the Summit, and have expanded their farm to school efforts since the Summit. The Center for Rural Affairs has been invited to present on farm to school at multiple NDE-NS workshops and trainings; NDE-NS continues to serve in an Advisory role on other farm to school projects. NDE-NS supported efforts for a Midwest Farm to School Conference in March 2016.

Several specialty crop producers who participated in the Summit are now leaders in farm to school, selling to schools, offering farm tours, and adjusting/expanding their products in order to meet school needs.

Offering another Nebraska Summit would be timely to bring key partners together to expand knowledge on extending seasons, connecting to schools, or increasing specialty crop acreage for school sales. Farmers need to continue to hear from each other that the school connection is valuable and attainable.

We have continued to supply technical assistance where needed to ensure successful farmer-food service director connections.

Beneficiaries

The Summit was attended by a total of 114 people, representing a total of 21 schools. Six of these schools represented urban populations or school districts of 5,000+ students, and 15 of the schools were from rural districts with student populations ranging from 107 to 2,186 (K-12). The total number of students that will be reached from the districts that attended the Summit is 112,904. Of this number, 9,791 of these students are from rural districts and 103,113 are from

urban or districts greater than 5,000 students. Of the 114 registrants, 51 identified themselves as food producers or representing food producers.

More than 50 specialty crop producers attended the 2014 Summit. We know that several of these producers have established solid farm to school relationships. Lone Tree Foods and Nebraska Food Cooperative are local food distributors who both participated in the Summit. Both are making multiple school sales every week. Several other individual producers are selling directly to schools.

Because of the Summit, confidence has increased and food service directors know that they are part of a greater movement. There is less fear in purchasing directly from producers and in handling fresh fruits and vegetables. School meal participation rates increase with farm to school on average of 9%.

USDA Farm to School Census data tells us that farm to school in Nebraska expanded in the 2014-2015 school year to 71 districts, with 458 schools affecting 188,637 students.

Lessons Learned

We had originally planned to host the Summit prior to October. However, we delayed the date because of conflicting summer scheduling for both schools and food producers (summer vacations, harvest and/or planting, et cetera). We were grateful that the Nebraska Department of Agriculture adjusted the grant timeframe from one year to three years. Additionally, because we were able to hold the Summit in October, we were able to capitalize on October being National (and Nebraska) Farm to School Month, bringing in additional media and attention to the Summit.

Continued follow-up with specialty crop producers who attended the Summit would be beneficial. Connecting the producers to the schools, but also to other distribution networks, is ideal. This can continue to be accomplished through the Nebraska e-newsletter, but is especially important that existing producer organizations networks be leveraged such as the Nebraska Department of Agriculture's produce listserv and Nebraska Sustainable Agriculture Society's listserv.

A marketing campaign dispelling myths that farm to school is not allowable would be desirable. In fact, parents, students, and USDA are all strong proponents of farm to school and purchasing local food.

The Summit was highly effective at growing the market, connecting schools and farmers, and increasing fresh, healthy food offerings to students. Evaluations from the Summit stated that 100% of respondents will definitely or probably pursue farm to school activities in the future. Offering a statewide Summit to address evolving needs would keep farm to school efforts and attraction for increasing specialty crop production moving forward.

Offer insights into the lessons learned by the project staff as a result of completing this project. This section is meant to illustrate the positive and negative results and conclusions for the project.

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Additional Information

Webinar for producers, 11/12/15, featuring Justin Jones of Lone Tree Foods. Justin attended the 2014 Summit. http://www.cfra.org/node/5980

Clear Creek Organic Farms hosts farm tour for school food service staff on 10/14/16. Robert and Kristine Bernt attended the 2014 Summit. http://www.cfra.org/news/161014/real-deal-farm-school-nebraska-farm

Norris Public Schools joined the 2014 Summit and are committed to continually increasing their local food purchases. They hosted Congressman Fortenberry for an apple crunch in 2015. http://www.cfra.org/news/151113/view-school-kitchen

UNL Extension joined the 2014 Summit, and their partnership with farm to school efforts continues to increase. Extension participated in this producer focused webinar with the Center 10/30/15. http://www.cfra.org/news/151030/reaching-new-market-farm-school-farmers-and-ranchers

Profile view of Aurora Public Schools who began their efforts in tandem with the 2014 Summit. http://www.cfra.org/news/150922/farm-school-profile-aurora-public-school

Nebraska Farm to School Summit Agenda

Wednesday, October 22, 2014 | *The Leadership Center, Aurora, Nebraska*

8:00 AM-9:00 AM	**Registration** *Lobby at The Leadership Center, Aurora, NE*				
8:00 AM-2:45 PM	**Exhibitions Open** *Blezek Hall (gymnasium)*				
9:00 AM-9:10 AM	**Welcome Message** *Center for Rural Affairs/NE Department of Agriculture/USDA Farm to School* *Lakeside Rooms 2-4*				
9:10 AM-9:30 AM	**Opening Keynote Address *"Statewide Action to Support Farm to School"*** *Senator Rick Kolowski*				
9:45 AM-10:45 AM	***Session A:* Breakouts**				
	Lakeside 1 *Impacting Policy Changes on a State Level: The Basics of the Policy Making Process & Building a Campaign* Anna Wishart Legislative Aide to Senator Rick Kolowski	*Lakeside 2-4* *Using a Forward Contract for Local Purchasing: for Growers and Schools* Robert Gorman USDA Farm to School Regional Lead	*Wedeking* *Farm to School: A Tool for Implementing Local School Wellness Policy* Zainab Rida, PhD, RD, LMNT Director of Nebraska Team Nutrition	*Mather West* *FSMA and GAPs: How They Affect Growers* Elizabeth Killinger University of Nebraska Lincoln Extension Educator	*Mather East* *Let's Grow!: Using Aquaponics to grow food and engage students in the classroom* Greg Fripp Executive Director of Whispering Roots
11:00 AM-12:00PM	***Session B*** **Lightning Round** *See complete program schedule for list of topics and presenters for this session.* *Lakeside Rooms 2-4*				
12:00 PM-1:00 PM	**Local Foods Lunch and Keynote: *"Living a Wellness Life"*** *Bryce Abbey, University of Nebraska Kearney, Assistant Professor of Exercise Science* *Mather Dining Hall*				
1:00 PM-1:30 PM	**Exhibitor Fair** *Visit a number of local organizations that are creatively increasing Farm to School capacity.* Blezek Hall *(gymnasium)*				
1:30 PM– 2:30 PM	***Session C:* Breakouts**				
	Mather East *Community Members* Facilitated by Zainab Rida *Nebraska Department of Education Team Nutrition*	*Mather West* *Food Service Professionals* Facilitated by Sharon Davis *NE Department of Education Assistant Director of Nutrition Services*	*Lakeside 2-4* *Food Producers* Facilitated by Wyatt Fraas *Center for Rural Affairs*		
2:30 PM - 2:45 PM	**Break- Afternoon Snack and Taste Test** *Mather (Dining Hall)*				
2:45 PM – 3:45 PM	**World Café** *Mather (Dining Hall) and Mather East*				
3:45 PM - 4:00 PM	**Closing Session** *Mather (Dining Hall)*				

Thank you for joining the 2014 Nebraska Farm to School Summit! Stay in touch, and drive safely home.

2014 Farm to School Summit Exhibitors:

- Action for Healthy Kids Alliance
- Buy Fresh Buy Local Nebraska
- Center for Rural Affairs
- FFA
- Grain Place Foods
- Gretchen Swanson Center for Nutrition
- Lone Tree Foods
- Nebraska Department of Agriculture
- Nebraska Farmers Union
- Nebraska Department of Education Nutrition Services
- Nebraska Food Cooperative
- Nebraska Mushroom
- Paradigm Gardens
- SARE
- UNL Extension
- USDA NE Farm Service Agency
- Whispering Roots

If $1 was spent on local food for each of the 345,200 public school students in Nebraska per month, $3,106,800 of school food dollars would go directly to local producers, bolstering our local economy.

Source: Gretchen Swanson Center for Nutrition

Senator Rick Kolowski has ignited statewide discussion on local food and how we can improve the production, processing, distribution and consumption of it in Nebraska. He has introduced a resolution, LR 545, for the purpose of studying statewide efforts that can be taken to improve Nebraska's access to local food supply and distribution networks. Senator Kolowski represents District 31 (Millard and Elkhorn), was an educator for over 40 years and the founding principal of Millard West High School.

NATIONAL FARM to SCHOOL MONTH

SPECIAL THANKS!!

Nebraska's Farm to School Summit was funded by the USDA's Specialty Crop Block Grant Program, administered by Nebraska Department of Agriculture.

Find us on Facebook www.facebook.com/NebraskaFarmToSchoolProgram

Nebraska Farm to School Summit 2014

October 22, 2014
9 AM - 4 PM
The Leadership Center
Aurora, Nebraska

CENTER *for* RURAL AFFAIRS

Nebraska Farm to School Summit

October 22, 2014, The Leadership Center, Aurora, Nebraska

Lightning Round Presentations

What great things are happening in Nebraska, and who are experts and resources in the field? This session consists of the following dynamic and informational presentations, and is meant to inspire and spark thought towards what farm to school opportunities might work in your unique schools and districts.

Farm to School: Connecting the Classroom, Cafeteria and Community
Zainab Rida, PhD, RD, LMNT: Director of Nebraska Team Nutrition with the Nebraska Department of Education
This session will highlight how farm to school provides hands-on educational experiences to connect children with the source of their food; how farm to school links nutrition education with the classroom, the lunchroom, the school garden and local farmers; and how farm to school benefits students, but provides a win-win-win for schools, farmers and the community.

School to Garden Success Story
Darcie Kvasnicka: 3rd grade teacher and school garden organizer at Norris Public Schools, Firth, NE
The Norris School Gardens Project allows students involved in the garden an opportunity to learn healthy eating habits and an appreciation for food production. This fosters a new element of health, nutrition, exercise, and education. Incorporating the garden in the educational process reinforces goals related to many curriculum areas. Garden education teaches concepts, and may be some of the most "real education" the students receive.

Nacho Everyday School Lunch!
Sarah Smith, 9th grader at Lincoln Public Schools, Lincoln, NE
Learn how a teenager brought local food into her school cafeteria; a real life example of Nebraska food making it onto Lincoln middle school students' plates, all with the help of a student with a vision.

What You Need to Know About Local Policy in 5 Minutes
Anna Wishart, Legislative Aide to Senator Rick Kolowski with the Nebraska State Legislature
Do you think politics isn't for everybody? Learn what a difference you can make in bringing access of local foods to Nebraskans, and especially our students. Senator Kolowski is proposing an interim study (LR545) for state-wide efforts that can be taken to improve Nebraska's access to local food supply and distribution networks. You can be involved.

Commercial Kitchens and How They Can Benefit Farm to School Relationships
Harold Stone, Farmer, Stone's Thoreau, Davenport, NE
Staff skill levels and a lack of time are often impediments to the use of fresh produce in school kitchens. Seeking out "kitchens of opportunity" to "slice and dice" raw materials into ingredients and prepared foods and condiments impacts the volume of local produce in the school. It also impacts the economic bottom line of the community by expanding the produce market and creating jobs in rural communities.

Healthy Chefs Night
Rebecca Chamberlin, Wellness Coordinator, Kearney Public Schools, Kearney, NE
Food, Family, Friends, and Fun! Northeast Elementary families always look forward to Healthy Chef Night! Come and learn how we get picky eaters to try healthy foods and have fun doing it.

Growing, Feeding, Educating
Greg Fripp, Executive Director of Whispering Roots, Omaha, NE
There is a different way to feed Omaha's urban population, many of whom currently live on fast food, skip meals and never see a fresh fruit or vegetable. And there is also a new way to teach students; a way to make science and technology and even math fun while getting kids invested in a project they remember all their lives. Whispering Roots is bringing the farm to the classroom in more ways than one. Hear about Aquaponics, an innovative tool that is working to teach children and bring school-grown food onto their plates.

An Introduction to Gourmet and Medicinal Mushrooms
William Ashley Gordon, Owner and Operator of Nebraska Mushroom, Grand Island, NE
This presentation provides an overview of the tastes, textures, and nutritional benefits of gourmet and medicinal mushrooms, including preparation ideas for delicious meals that will promote a healthy learning environment and proper physical development for students in our school systems.

Empowering Wellness Champions to Create Healthy School Environments
Ashley Carroll, Nebraska State Coordinator, Action for Healthy Kids
We know that well-nourished, physically active children are healthy, high-performing students. At Action for Healthy Kids, our goal is to make every kid healthy, and that can only be realized by each parent, family member, teacher and administrator making a commitment to create healthy school environments. Farm to school partnerships are part of that equation. Healthy school environments begin with wellness champions like you!

Just Do It!
Diane Zipay, Director, Westside Nutrition Services, Omaha, NE
Just do it! That is the theme of this no nonsense presentation on bringing locally grown produce to your school kitchen. Where do you start? Who do you call? Where do you get it? Is it safe? It is easier than you think, and just like the garden, once you plant the seed of "farm to school", it will grow without much effort.

CENTER *for* RURAL AFFAIRS

Project Title

Evaluation and Enhancement of Insect Pest Resistance in Confection Sunflower

Project Summary

Confection sunflower is defined by its use as an edible, in-shell product. Traditionally confection sunflowers have been consumed with very little processing aside from roasting and salting. However, the market for confection sunflower is growing and becoming more diverse. Sunflower seeds are now often sold with a variety of flavorings (dill pickle, Bar-B-Q, ranch dressing) and more unusual confection sunflower products are targeted to niche markets by including added caffeine and other nutritional elements such as amino acids and vitamins.

To keep confection sunflowers grown in Nebraska competitive both domestically and internationally, growers must be able to produce a crop that is high quality while controlling costs of production. By reducing yields and requiring changes to cultural practices, including direct pest management, insects lower both the overall quality and profitability of confection sunflower. Insect-related losses also reduce the attractiveness of confection sunflower as a part of a diversified farming system in Nebraska.

Averaged over the last five years, U.S. farmers planted 335,000 acres of confection sunflower. Of that total, about 22,000 acres each year have been planted by Nebraska farmers. While this acreage trails that of larger sunflower-producing states like North Dakota and Minnesota, the U.S. confection industry has found concentrated production too risky in many years and has spread acres to reduce their overall risk. Nebraska is part of this expanded area and the industry recognizes the state as having good production potential.

Nebraska confection growers, in particular, face significant challenges in the world market relative to insects. Because the primary sunflower pests in Nebraska are common only in the Central Plains and have not spread outside of North America, confection yields in countries such as China and Argentina are not limited by pressure from insect pests. Even within the United States (U.S.), confection sunflower may be more difficult and costly to produce in Nebraska, as growers in North Dakota (typically about 50% of U.S. confection acreage) only rarely encounter problems with the insect pests that thrive in Nebraska. Problems with insect pests are also considered to be more severe in confection relative to oilseed sunflowers.

The primary pest of sunflower in Nebraska is the sunflower moth, *Homoeosoma electellum*, which produces the most severe damage of any sunflower insect in North America. Because larvae of the moth cannot survive cold winters, significant damage by the moth is usually restricted to Nebraska and areas to the south. Adult moths are attracted to lay eggs among florets in pollinating sunflower. As the larvae (caterpillars) grow, they move from feeding on pollen to disk florets and seeds. Late planting is useful to limit the severity of infestations, but when high numbers of moths are present during bloom, two or three insecticide applications several days apart may be used. Both physical and chemical host plant resistance have been discovered for oilseed sunflower, but neither has been transferred into confection sunflower hybrids.

Other sunflower insect pests include sunflower stem weevil, Cylindrocopturus adspersus*, and Dectes stem borer,* Dectes texanus. Feeding by stem-infesting insects can cause sunflower

stems to lodge (reducing the number of plants that can be mechanically harvested), but recent research indicates that both of the stem-feeders may be best managed by cultural practices, particularly by limiting plant populations to produce plants with stems that can tolerate their feeding and remain upright.

While insecticides are part of the answer for managing sunflower moth in confection sunflower, there are several reasons to try for a more balanced, integrated pest management (IPM) approach. First, while insecticides can be effective in reducing losses, they may also represent significant production costs to confection growers. Based in part on cost-return data for the Central Plains, the consequence of requiring three insecticide applications (at $10 per acre, per application) rather than one per season could reduce confection profitability by one-third. Aside from the cost of insecticide applications, because of problems including unsuitable weather and human error (for example, a late application), targeting pests with one or more insecticide applications is not always effective. Also, fewer effective options for insecticidal control are available as products are taken off the market. Lastly, the frequent use of a small number of insecticides to control sunflower moth (or any other pest), risks the development of insecticide resistance, removing a useful pest management option.

The approach for this project includes two primary objectives. First, because of the lack of information on insect resistance in confection sunflower germplasm, field trials in Nebraska were used to assess pest susceptibility of confection inbreds and hybrids for sunflower moth. Both public and private germplasm were included in the field tests. Second, resistance data was generated in field trials of a sunflower mapping population, which was used to map trait(s) contributing to sunflower moth resistance. The mapping work will facilitate future breeding of confection sunflowers with decreased susceptibility to this pest in both public and private sector programs.

Project Approach

Work Plan Year 1: Screen public and private confection germplasm for possible resistance to sunflower moth. Field trials were planted in Nebraska (at two locations for 'disaster insurance'). We divided this plan into three sub-objectives: **1)** Evaluate the rate of pericarp hardening in confection and oilseed sunflowers; **2)** Evaluate the effect of pericarp hardening on sunflower moth larval feeding (semi-field); **3)** Evaluate the impact of sunflower moth resistance on sunflower yield components (field). A graduate assistant (GA) was recruited and employed to address these specific objectives. The GA conducted the summer field trials.

Methods Summary. Fifteen commercial confection sunflower hybrids were planted along with 7 public lines or varieties (22 entries total) in a randomized complete block field design in mid-May at the Panhandle Research and Extension Center in Scottsbluff, Nebraska. A second location was also planted in this arrangement at the Mitchell Station as a back up, but was not needed. The target structure on the sunflower plant for resistance to the sunflower moth is the seed (or achene) and specifically the pericarp of the seed. It is generally known that the harder the pericarp of the seed, the more resistant the seed to the feeding of sunflower moth larvae. Because some of the public breeding sources of confection sunflowers are oil-seed sunflowers, 8 public oil-seed varieties were also included in the field trial. Data collection began in July when plant development reached R5. Anthesis began on July 17th and was recorded through July 30th, when all plants were selected for inclusion in this study. Developing achenes were collected on days 7, 14, and 21 after anthesis (i.e., fertilization) for data collection and measurement. Pericarp hardness was measured using a penetrometer to detect resistance of the pericarp to

puncture. Pervious data from the USDA-ARS Sunflower Unit had shown this technique to relate well to pericarp resistance to sunflower moth larval resistance.

Results Summary. On Day 7 after anthesis, pericarp hardness for confections and oil varieties showed low hardening (Figs. 1 and 2). Pericarp hardening improved little by Day 14 after anthesis. At day 14 and 21, after anthesis, some commercial hybrids show equal or greater strength than other public lines, meaning there may be little room for improvement in pericarp strength for those varieties. Interestingly, some oil varieties did not improve in hardness over the course of the study and remained low in hardness in comparison to confections. The data recording and analysis for these data were completed. Further analysis was carried out during the winter and data was used to strategically plan Year 2 work. Additionally, the data was shared at the ESA Annual Meeting in Portland, Oregon.

Much progress was completed in Year 1 toward the goal to assess the degree of insect resistance in confection sunflower hybrids. Further analyses was required his winter to specifically plan a field mapping of these resistance characteristics. Sub-objectives 2 and 3, which were not specifically outlined in the original proposal, was further analyzed and reported at a later time.

Dr. Jeff Bradshaw contributed his time and guidance to a Graduate Assistant who worked on this project. Dr. Bradshaw coordinated the establishment of the GA's advisory committee, which includes the co-advisement of Dr. Gary Brewer (University of Nebraska – Lincoln, entomology). Dr. Jarrad Prasifka (USDA-ARS) is also serving on the GA's advisory committee and providing much guidance to the GA. Additionally, Dr. Prasifka has also advised on plot and sampling design through the year and has provided or coordinated the seed for the field study. Furthermore, Dr. Prasifka has also made colony sunflower moth material available for sub-objectives 2 and 3.

Work Plan Year 2: In year two of the project we replicated sub-objective 1 and initiated sub-objectives 2, and 3. The GA again conducted the field and laboratory bioassays needed to achieve these objectives.

Methods Summary. Field trials for 2015 were set up similarly to 2014 with a complete randomized block design at the Scottsbluff Panhandle Research and Extension Center. Varieties 3, 4, 19, and 20 were selected based on pericarp hardness rate data from 2014. These varieties were planted on three separate dates to ensure inflorescence on the same date for the start of data collection. Samples were collected at five different time points to determine detailed developmental rate. These days after anthesis (DAA) were 10 days, 14 days, 16 days, 18 days and 21 days. Sample collection was completed by the end of August and yield samples were collected at the end of September.

Samples were analyzed in lab with a penetrometer upon collection from the field following storage in a walk-in cooler (40°F). These samples were tested again after 3 months of storage data (Fig. 1), because there was a need to determine the potential effects of long-term storage on our samples.

No choice bioassays were performed in the lab when larvae reached 4th instar from a laboratory reared colony. Colony was stored in an incubator on a 14/10 photoperiod to produce a month generation cycle. From this colony, larvae were selected for inclusion into the no choice bioassay. Five larvae were placed in a petry dish with 5 seeds from an early DAA development

time point and 5 seeds from a later DAA development time point. Five seeds from 10 DAA were placed on a dish with 5 seeds from 18 DAA. Five seeds from 14 DAA were placed on a dish with 5 seeds from 21 DAA. There was a total of 10 seeds on each dish. Each sample entry was replicated 5 times for a total of 30 replications for each variety included in the 2015 field study.

Developing achenes were collected 10, 14, 16, 18, and 21 days after anthesis (i.e., fertilization) to be tested for hardness. Pericarp hardness was measured using a penetrometer to detect resistance of the pericarp to puncture. Pervious data from the USDA-ARS Sunflower Unit had shown this technique to relate well to pericarp resistance to sunflower moth larval resistance.

Results Summary. Of the four entries that we evaluated in 2015, the confection pericarps again achieved about 4.3-5.5 newtons greater in pericarp hardness relative to oilseed pericarps (Fig. 4**)**. In laboratory bioassays, a clear trend can be seen between pericarp hardness between all four entries and number of seeds consumed (Fig. 4, Table 1). None of the of the varieties showed any resistance to sunflower moth larval feeding at 10 days post anthesis (Table 1, range of 2 – 4 newtons in pericarp hardness), while any variety or time point that acceded an average of 4 newtons in pericarp hardness appears to correspond to reduced larval feeding. These data indicate that breeding sunflowers for achenes whose pericarps hardened greater than 4 newtons faster will provide some resistance to sunflower head moth injury. Additionally, using a penetrometer and testing for pericarp hardness could be used to screen a wide number of confection sunflower entries for probably resistance to sunflower head moth before plants are taken to the field.

Additional observations from this field season highlighted information on a phenomenon known as heat, which is an abiotic condition that effects developing sunflower and may kill or stunt growth. Along with heat canker, data was collected on the overall loss of sunflower heads due to head clipping insects. Preliminary information indicates that HA467 and HA441 are susceptible to losses from developing heat canker, with HA467 most susceptible with a loss of up to 40% of all plants affected by canker (Table 5). RH841 had a high incidence of heat canker, but only about 12% were lost. Additionally HA441 was impacted heavily by head-clipping insects.

Dr. Jeff Bradshaw contributed his time and guidance of a Graduate Assistant dedicated to this project. The GA's advisory committee continues to provide much guidance to members of the GA's thesis committee. Additionally, Dr. Prasifka continues to provide expert advise on plot and sampling design through the year and has provided or coordinated the seed for the field study. Furthermore, Dr. Prasifka has also made colony sunflower moth material available for sub-objectives 2 and 3. From this material, the GA has also established and maintained a sunflower moth colony in Scottsbluff, Nebraska, to facilitate her studies.

Goals and Outcomes Achieved

Goals: The goals of the project were to assess the degree of any insect-resistance in confection sunflower hybrids and to develop new sources of resistance for confectionery hybrid development through breeding and genetics research.

Outputs: The most basic outputs are estimates of relative resistance to insect pests among confection germplasm by using comparisons to previously tested oilseed materials. Additional outputs are genetic markers or physical traits that can be used for private and public breeding of insect resistant confection sunflower germplasm using publicly available resistance sources. A sunflower production guide (edited by Dr. Bob Harveson, plant pathologist, UNL) was published

(see Additional Information). Information collected as a course of this project was translated directly into that guide. The chief intermediate output from year 1 of this project was performance evaluation of Dr. Hulke's sunflower-moth resistant sunflower lines in Nebraska and the Central High Plains.

Impacts: Anticipated impacts in the long-term include the production of confection hybrids with reduced susceptibility to insect pests common to Nebraska and other central or southern growing areas.

Beneficiaries

There are two primary types of benefits from the project. First, reducing the need for insecticide applications or increasing the effectiveness of insecticides when they are needed directly increases the profitability of confection sunflower production in Nebraska. Research in other cropping systems shows that insect resistance combined with other management tools (insecticides or cultural controls) produces greater yields than single management strategies used alone. The second type of benefit is increasing the attractiveness of confection sunflower production in Nebraska. The perceived difficulty in managing sunflower moth effectively limits the number of growers willing to start or continue growing confection sunflower in Nebraska. The degree to which management could become easier would be beneficial for increasing confection acreage in Nebraska.

Success of this project would be important to neighboring states as well such as Kansas, Colorado and Texas. All three states are also in the geographic range where sunflower moths can be consistent problems for confection producers and produce confection sunflower over a similar amount of acres.

Greater impacts could be realized if the boundaries of pest infestations change in the future. Warmer years with early springs, as seen recently in 2012, have resulted in significant numbers of sunflower moths seen in locations such as North and South Dakota. While these moths can be found in early fall as far north as Canada, warm or early spring seasons enable them to move north earlier when sunflowers are still in bloom and susceptible to sunflower moth damage.

A direct economic benefit of success in the proposed research would be the reduction or elimination of insecticide treatments. At a $10 per acre estimate for insecticide costs, elimination of one application could save Nebraska producers $220,000 annually. Other regions of the High Plains could save another $1,100,000 annually based on one application and using the USDA NASS five-year average of planted acres. Other potential benefits, including increased acreage for confection sunflowers in Nebraska or savings from reduced insect losses, are difficult to estimate. However, in severe infestations, sunflower moth is capable of producing losses of 50% or more of a grower's potential yield.

Lessons Learned

No substantial delays, impediments, or challenges were confronted related to the goals and expected outcomes of this project.

The project team continues to seek funding for the much larger budget submitted with the original project to enable the team to reach impact outcomes that are broader than the scope of the original project proposal. Additionally, a graduate student's thesis is currently being

completed and at least one peer-reviewed publication from that work is anticipated to be submitted in 2017.

Contact Information

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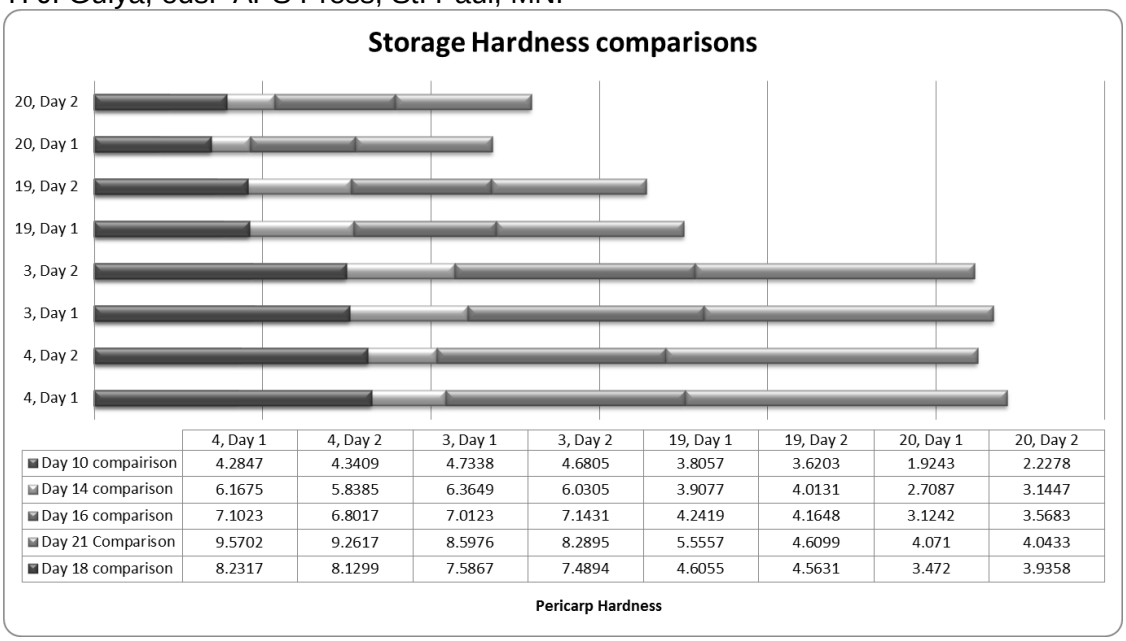
Additional Information

Presentations:
Sikora. D., J. Bradshaw, J. Prasifka, and G. Brewer. Confections and Oil sunflower pericarp hardness evaluation, ESA Annual Meeting, Portland, OR, 10, November 2014. (120 in attendance)

Press Release:
Bradshaw, J. and D. Sikora. 2014. Panhandle Entomology Research Update: Sunflower moth. Star Herald, June 2014.

Books:
Compendium of Sunflower Diseases and Pests. R. M. Harveson, S. G. Markell, C.C. Block, and T. J. Gulya, eds. APS Press, St. Paul, MN.



	4, Day 1	4, Day 2	3, Day 1	3, Day 2	19, Day 1	19, Day 2	20, Day 1	20, Day 2
Day 10 compairison	4.2847	4.3409	4.7338	4.6805	3.8057	3.6203	1.9243	2.2278
Day 14 comparison	6.1675	5.8385	6.3649	6.0305	3.9077	4.0131	2.7087	3.1447
Day 16 comparison	7.1023	6.8017	7.0123	7.1431	4.2419	4.1648	3.1242	3.5683
Day 21 Comparison	9.5702	9.2617	8.5976	8.2895	5.5557	4.6099	4.071	4.0433
Day 18 comparison	8.2317	8.1299	7.5867	7.4894	4.6055	4.5631	3.472	3.9358

Figure 1. Comparisons of pericarp hardness for four varieties (3, 4 19, and 20) following no days of storage (Day 1) and 90 days of storage (Day 2) at 40°F.

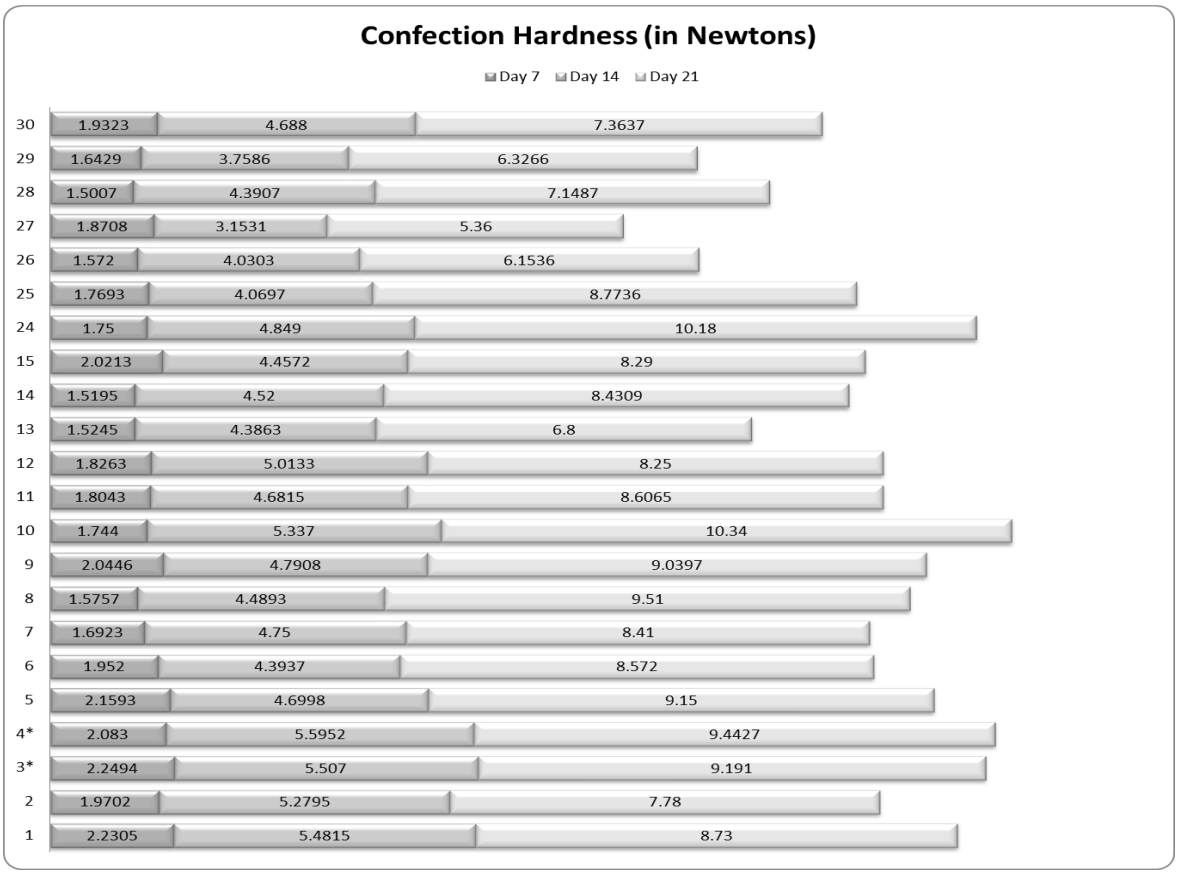


Figure 2. Achene pericarp hardness of 22 confection sunflower entries from plants grown in the field in 2014. Hardness was determined for each entry at 7, 14, and 21 days post anthesis. The red-boxed entries were chosen to evaluate further in 2015.

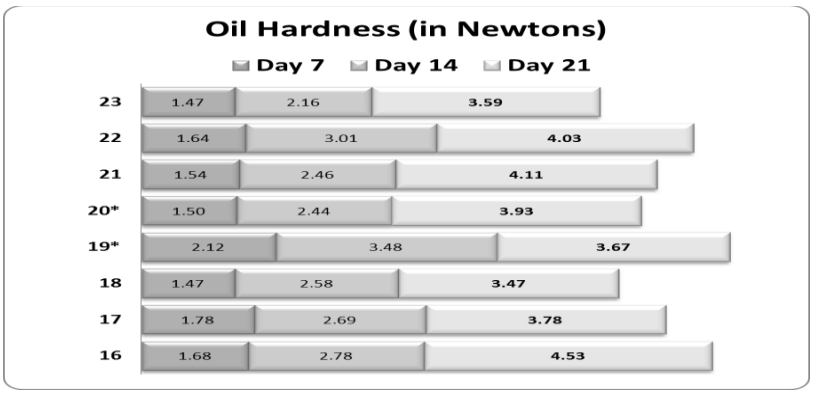


Figure 3. Achene pericarp hardness of 22 confection sunflower entries from plants grown in the field in 2014. Hardness was determined for each entry at 7, 14, and 21 days post anthesis. The red-boxed entries were chosen to evaluate further in 2015.

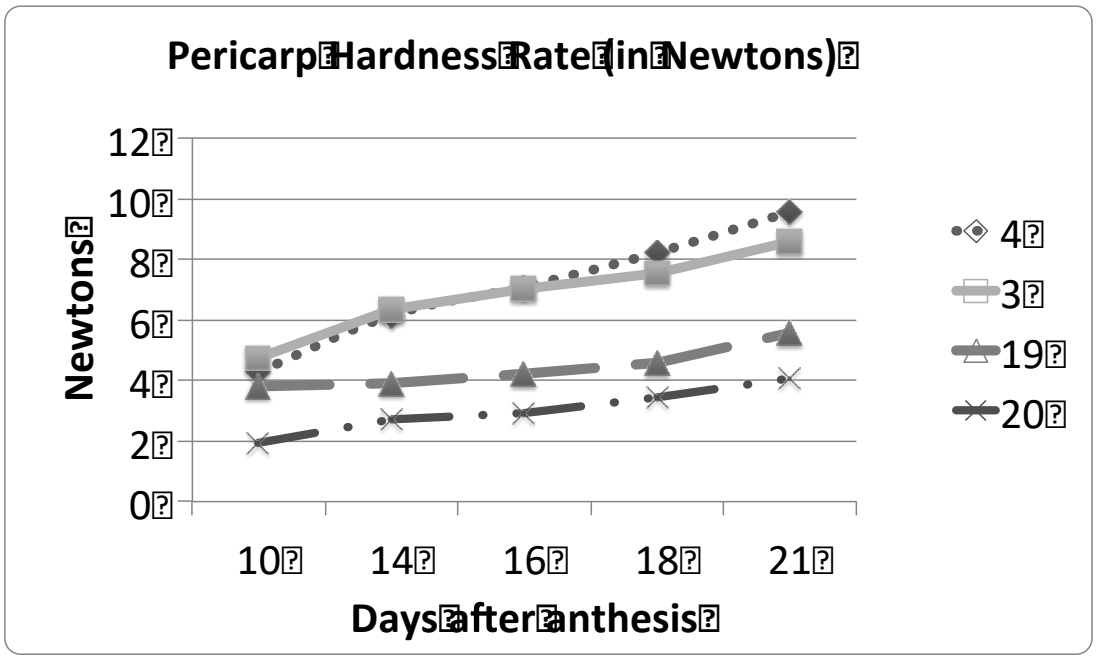


Figure 3. Relative pericarp hardness between two confection and two oilseed sunflower varieties over five time points.

No Choice Bioassay Seeds Consumed for each DAA				
DAA	10	14	18	21
Variety	**Estimate**	**Estimate**	**Estimate**	**Estimate**
4	0.62	0.00	0.07	0.00
3	0.57	0.10	0.00	0.07
19	0.13	0.07	0.00	0.00
20	1.23	0.17	0.20	0.13

Table 1. Average consumption of sunflower seed by sunflower moth larvae at 10, 14, 18, and 21 days after anthesis (DAA).

Variety	Total canker loss	Total cankers	Total head clip loss	%cank loss
3	7	63	7	11.11%
4	16	131	12	12.21%
19	28	106	35	26.42%
20	14	35	11	40.00%

Table 2. Number of sunflowers lost per variety due to head clippers and heat canker.

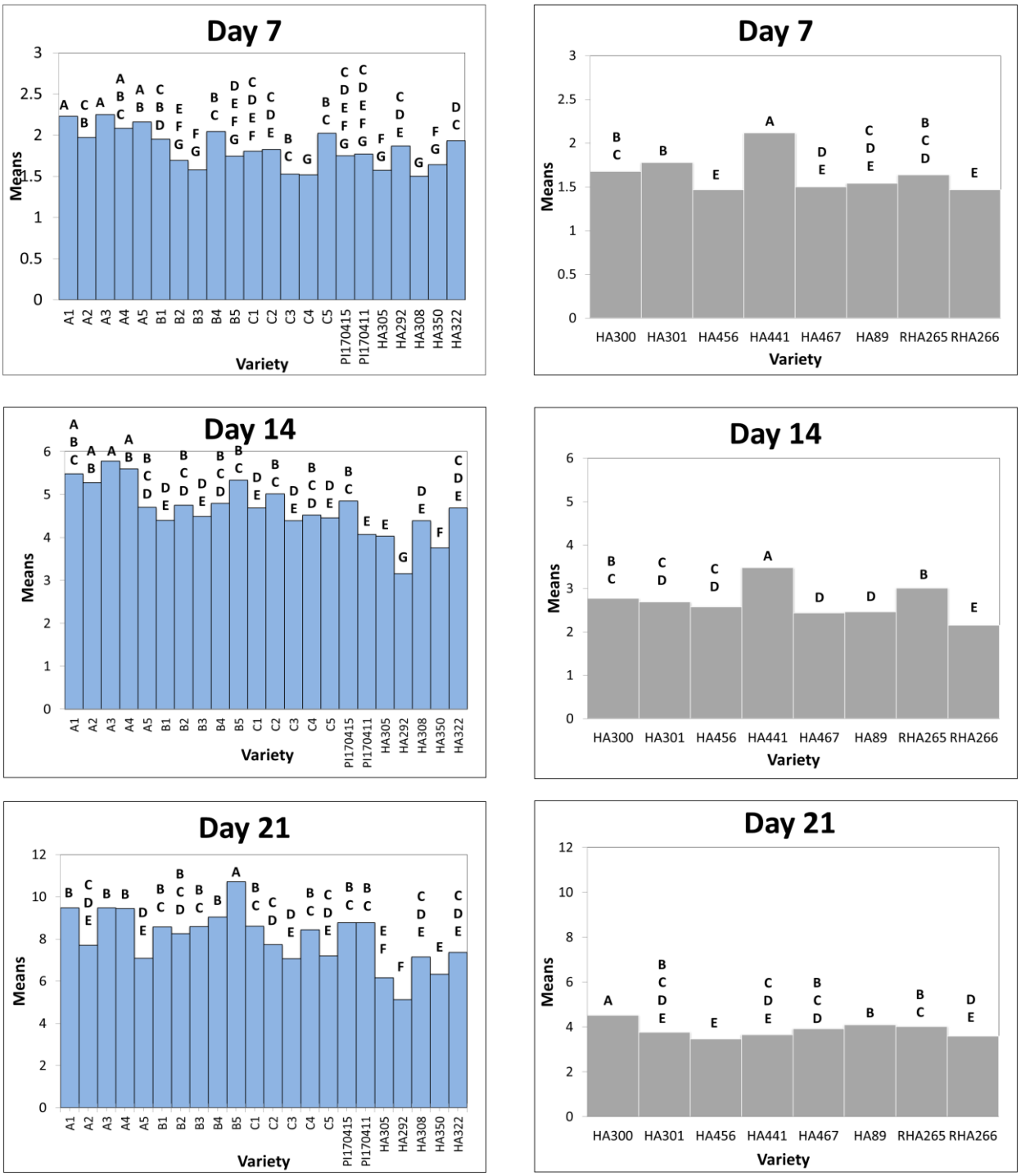


Figure 4. Confection (left column) and oil seed (right column) sunflower pericarp hardness (newtons) at 7, 14, and 21 days post flower anthesis. Bars with different letters indicate significant differences at p-Val < 0.05. Commercial entries are listed b

Project Title

Japanese Beetle Survey

Project Summary

The goal of this project is to conduct a comprehensive survey of Nebraska nursery dealers and growers, to determine the presence or absence of Japanese beetle (*Popillia japonica*) populations at those facilities. This information is then used to certify Nebraska grown nursery stock for international and interstate movement, to areas that have enacted quarantines to prevent the introduction of Japanese Beetle.

Since October 1, 2013, Nebraska Department of Agriculture (NDA) Entomology staff has recorded over 180 hours and have driven over 3,967 miles to meet the goals of this project.

Project Approach

2014

In 2014, a total of 161 JB traps were set in non-infested counties. Forty-nine traps were set in known infested counties. Traps are located at airports, state parks, special quarantine compliance areas, and nursery growers and dealers. Nursery dealers and growers in non-infested counties that import balled and burlapped nursery stock are considered high-risk sights and, therefore, trapped individually. The traps were in place from the end of May until October.

After the 2014 trapping season, NDA declared three more counties as being infested with JB; these counties consisted of Jefferson, Madison, and Phelps. Prior to 2014, Adams, Buffalo, Cass, Dakota, Dawson, Dodge, Douglas, Gage, Hall, Hamilton, Lancaster, Lincoln, Saline, Sarpy, Saunders, Seward, Thayer, Washington, and York were already listed as “infested.”

Soil sampling for JB grubs was conducted in 2014, at select firms in known infested counties, where JB populations had previously been confirmed via trapping. Firms were selected based on several factors, including level of infestation, nursery production methods, and desire to ship out-of-state. A total of 155 soil samples were collected over 40 acres from two firms in three counties. No JB grubs were found.

In 2014, NDA entered into eight compliance agreements at five different firms that regularly ship nursery stock interstate. These firms generally have a strong track record of interstate shipping and have demonstrated their willingness and ability to understand and follow requirements under the Nebraska Plant Protection and Plant Pest Act and those of the receiving state. Firms under a compliance agreement must sign an agreement with NDA, attesting that they will meet certain standards. They are then able to certify their own shipments as meeting a specific state’s JB entry requirements. NDA staff continues to survey, inspect, monitor treatments, and oversee the firms, and will terminate the agreements if used improperly.

Firms in known infested areas that wished to ship interstate or internationally may request to have their nursery stock certified, based on the application of specific chemicals, trapping data, or bareroot material. Prior to the phyto being issued, NDA inspectors are required verify the method of certification. NDA has issued seven state and federal phytos to facilitate the

movement of nursery stock interstate and internationally, certifying 2,406 individual plants as meeting the JB requirements of the receiving state or country.

2015

In 2015 NDA entered into eight compliance agreements at five different firms that regularly ship nursery stock interstate. NDA staff continues to survey, inspect, monitor treatments, oversee the firms, and will terminate the agreements if used improperly.

Firms in known infested areas that wished to ship interstate or internationally may request to have their nursery stock certified, based on the application of specific chemicals, trapping data, or bareroot material. Prior to the phyto being issued, NDA inspectors are required verify the method of certification. NDA has issued four state and federal phytos to facilitate the movement of nursery stock interstate and internationally, certifying 762 individual plants as meeting the JB requirements of the receiving state or country.

In addition, NDA staff conducted the JB Greenhouse Certification inspection and witnessed two treatments of nursery stock for JB certification.

In addition to the work above, activities conducted in 2015 were related to dissemination of information from the 2014 survey and listed below.

Goals and Outcomes Achieved

The measurable outcomes for this project include the following:

1. Disseminating survey information in the NDA Entomology Program Annual Report;

2. JB certification requirements were mailed to all Nursery Stock Distributors Incorporating project results on the NDA web site;

3. Inclusion of survey results on the NDA Entomology Program display booth at Nebraska Great Plains Conference; and

4. Submission of relevant articles to the NNLA newsletter.

Each objective has been met. The supporting documentation is provided below.

2014

1. Information on NDA JB Survey activities was included in the 2013 NDA Entomology Program Annual Report. These reports are disseminated at various meetings and events throughout the year.

2. During the Spring of 2014, information on the survey and shipping requirements related to JB certification were mailed to all Nebraska Nursery Stock Distributor licensees, which is approximately 1,300 firms.

3. The JB survey information was also updated on the NDA web site after the survey was complete.

4. Information on NDA JB Survey activities were disseminated at the Nebraska Great Plains Conference in Lincoln on February 2014. This included information on the 2013 survey results and updated information on infested counties. Information on how to request a site to be surveyed was available at this event, along with information on interstate and international shipping and receiving requirements. This event had 800 registered attendees from the nursery, landscape and forestry industries.

Additional outreach was conducted at the following venues:

1. Governor's Ag Conference held in February 2014 that consisted of approximately 200 attendees;

2. Great Plains NNLA/NAA Summer Field Day in August 2014, which consisted of approximately 75 individuals from the nursery and arborist industries; and

3. Cornhusker Harvest Days in September 2014, which consisted of an attendance of 335,000 individuals.

This outreach included display boards and informational handouts with specific information on JB, the NDA Entomology Program Annual Report, survey and trapping work, and interstate and international shipping and receiving requirements.

Japanese beetle survey results and certification information for shippers were included in an article published in the Summer 2014 Nebraska Nursery and Landscape Association newsletter.

2015

1. Information on NDA JB Survey activities was included in the 2014 NDA Entomology Program Annual Report. These reports are disseminated at various meetings and events throughout the year.

2. During the Spring of 2015, information on the survey and shipping requirements related to JB certification were mailed to all Nebraska Nursery Stock Distributor licensees, which is approximately 1,300 firms.

3. The JB survey information was also updated on the NDA web site after the survey was complete (www.nda.nebraska.gov).

4. Information on NDA's JB Survey activities was disseminated at the Nebraska Great Plains Conference in Lincoln, January 2015. This included information on the 2014 survey results and updated information on infested counties. Information on how to request a site to be surveyed was available at this event, along with information on interstate and international shipping and receiving requirements. This event had 800 registered attendees from the nursery, landscape and forestry industries.

Additional outreach was conducted at the Governor's Ag Conference, held March 2015, with 200 attendees; This outreach included display boards and informational handouts with specific

information on Japanese beetle, the NDA Entomology Program Annual Report, survey and trapping work, and interstate and international shipping and receiving requirements.

Beneficiaries

This project provided benefits nursery growers across the state by allowing the export of their plant products.

Lessons Learned

While Japanese beetle has become established in parts of the state, we can still mitigate trade implications for Nebraska producers through the continuation of this project. Communication with industry on the distribution of Japanese beetle in the state, and how that may impact shipping requirements is vital, to ensure the ability of industry to move product. Educating industry on these requirements and the various means of meeting them is ongoing.

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Project Title

Strengthening Our Local Food System and the Business Skill of Specialty Crop Growers

Project Summary

The purpose of this project was to increase the awareness and purchase of locally grown specialty crops in Nebraska through the Buy Fresh Buy Local Nebraska program (BFBLN). BFBLN has been working with specialty crop growers in the state since 2005. Since then, members have reported an increase in their sales each year and contributed at least a portion of this increase to the efforts of BFBLN. Much of the promotional efforts, outreach, and educational activities coordinated by BFBLN have been focused on the eastern third of the state. This project will help expand the BFBLN program to the other two-thirds of the state.

BFBLN is a program of the University of Nebraska – Lincoln's (UNL) Nebraska Cooperative Development Center (NCDC). BFBLN partnered with NCDC to provide educational workshops and trainings to assist specialty crop growers in Nebraska to not only gain knowledge but also change their marketing and business management behaviors to sustain successful, profitable businesses.

Project Approach

BFBLN held four Local Food Awareness listening meetings across the state. They were promoted and advertised through press releases to news media outlets, BFBLN's listserv, website, and Facebook page. Meetings were held in Wayne, Grand Island, and Scottsbluff. (The number in parentheses indicates the number of attendees at each session.)

Wayne, Nebraska (15). Attendees expressed the need for more information regarding business plan development, GAPs certification, financing, and how to market their products in their community and in the larger metro area.

Ord, Nebraska (14). The attendees wanted to know how to strengthen their farmers market and other direct-to-consumer sales opportunities developed on the farm. They were interested in exploring non-technical, cost-effective promotional activities.

Grand Island, Nebraska (12). Those who attended wanted to know how to develop a business plan. This began by asking the following questions'

a. What are the most profitable products to raise?
b. How can the Internet be used to help with promotion?
c. How can GAPs training be obtained?
d. What financing options are available?

The attendees wanted to network with each other to learn from one another about growing food in their area and extending the season using hoop houses and other season extension techniques.

Scottsbluff, Nebraska (5). Those who attended are growing specialty crops and wanted to know how to strengthen their year round farmers market to increase attendance and sales. They also had interest in food safety, how to get the community more involved in local food purchases,

what regulations exist for selling to schools, and how to encourage grocery store purchases from local farmers.

From these listening sessions, we were able to develop a workshop curriculum. A total of 46 specialty crop growers participated in the listening sessions of which 45 were new to the BFBLN program.

Educational Workshops

The workshops were open to anyone, but the focus and topics were geared toward specialty crop growers. The purposes of the workshops were to provide education, but also change marketing and business management behavior to sustain a successful, profitable business.

BFBLN developed a curriculum that covered topics requested during the listening sessions, which included business planning, enterprise budgeting, financing, GAPs training, and how to use social media and email to promote their business and increase sales.

One farm tour was held near Norfolk, Nebraska, which was geared for consumers and interested specialty crop growers. Eighteen attended the tour, which consisted of 10 consumers and 8 farmers. The tour was held at Wolff Farms.

Wolff Farms is an organic specialty crop business that grows vegetables. They own three high tunnels. Attendees learned about the challenges of growing specialty crops. Participants also learned about crop rotation, harvesting, and preparation of crops for direct-to-consumer sales. The attendees said they have a greater understanding and appreciation of what farmers have to do to get local food to consumers. The farmer answered questions about crop rotation, hoop house production, and row crop production. Participants were able to make a comparison as to the advantages and disadvantages of growing crops under a hoop house.

Ten consumers participated in the tour and gained a better understanding of how their food is grown. Eight specialty crop growers were in attendance to learn new practices and to interact with consumers**.**

NCDC partners with BFBLN on this project. Jim Crandall of the NCDC has been deeply involved in the planning and execution of each phase of the project and serves as one of the instructors for the workshops. Mr. Crandall was also one of the presenters in the webinar produced.

Farm Tours

We completed three farm tours that were targeted towards consumers and interested specialty crop growers.

The first farm tour was in Grand Island, Nebraska, at the Nebraska Mushroom, LLC farm with 71 in attendance. The farmer gave a tour of the facility giving attendees a detailed talk about the operation and answered question for 62 consumers and 9 farmers. They gathered valuable information about the 22 varieties of mushrooms that the farmer raises. He led them through the steps of preparing the growth for mushrooms -- from spores to how to prepare the growing medium for safe mushroom production. He discussed how and when to harvest, and the many ways one can prepare mushrooms for health and dining experience. The tour received high marks and the attendees said they gained knowledge about the pros and cons of mushroom

production. All but 1 attendee gave the tour the highest grade for information gathered. Attendees said they have a much better understanding about the different stages of mushroom growth and proper handling of them from spore inoculation to harvest and packaging. Several that said they want to start to grow mushrooms as a business.

The second farm tour of 2015 was held in Ceresco, Nebraska, at Martin's Hillside Orchard. Attendees enjoyed an educational and tasting tour of the different apples that were in season at the time the tour was held. The farmers gave an in depth talk about growing apples. They discussed where to purchase the variety of root stock needed for particular apple varieties that will do best in Nebraska's climate. Attendees learned why the Martins grow 21 varieties and how they choose different varieties that will extend the growing season for the orchard and widen the selling window for their specialty crop farm. The Martins also discussed how to plant, water, mulch, and prune the trees for optimal production. A total of 41 people participated in the tour, which consisted of 8 farmers, 26 consumers and 7 University of Nebraska students. The tour received very high marks for interest, presentation, and knowledge gained.

The third farm tour was held in Valparaiso, Nebraska, at the Heartland Nuts 'n More Cooperative.

Attendees learned that northern pecans and black walnut varieties are a result of expert scientific research, experimentation, and grafting. Much of the varietal work was done at the University of Nebraska-Lincoln. The coop manager discussed how to choose the root stock and scion woods for the best flavor and earlier harvest. Attendees increased their knowledge of the different types of grafts to use, how long it takes to obtain a crop, when to harvest, how to cure the nuts for processing, and selecting the quality nuts for packaging. There were 40 attendees, 7 farmers, 28 consumers, and 5 University of Nebraska students. The tour received very high marks for content, presentation and knowledge gained.

Videos

Four video were professionally created to promote four different specialty crop growers in Nebraska. The videos featured: Lakehouse Farm, Prairie Plate Restaurant (a farm to table operation), Oak Ridge Farms (a year round lettuce grower), Grow with the Flow (an aquaponics operation), and Nebraska Mushroom (mushroom grower and processor). A small dinner event was held in March 2016 to release the videos to the public. Fifty people from the Lincoln area attended and had an opportunity to visit with the farmers featured in the films. Since then, the videos have received 1,925 views. The video can be found at http://mediahub.unl.edu/media/5170.

Goals and Outcomes Achieved

Goal #1: Expand BFBLN programs to specialty crop growers in other areas of the state to assist growers and customers gain better access to specialty crops.

Results of Measurable Outcome #1: The number of specialty crop producers participating in BFBLN programs and activities was expected to increase by 20, but it did not increase. There were new members to BFBLN during the grant period, but there were also some members who left (transitioned out of farming). This fluctuation resulted in a membership base that did not increase at the rate we projected.

2: Goal #2: Increase profitability of BFBLN specialty crop members across the state by increasing knowledge of specialty crop growers pertaining to business skills. This will include increased understanding of marketing and business management (books, inventory, cost of production, etc.).

Results of Measurable Outcome #2: Project staff measured student knowledge of specialty crop agricultural businesses and food safety practices through pre- and post-tests. Below are the results.

A workshop format was used to present the curriculum. Each participant received a notebook of resources pertinent to each of the five topics. Participants were asked to evaluate the workshops at the conclusion of the program. Participants evaluated the workshop on a scale from 1 to 5, with 1 being the high mark.

Did the workshop increase your knowledge?
All attendees marked "yes" with comments that they appreciated the workbooks that they could take home.

Did the workshop improve your competence in business?
All attendees marked "yes" with comments that they need to have a business plan in place. Participants also stated they have a better understanding about GAPs, and they appreciated the cost analysis segment.

Did the workshop change your approach to your business?
All attendees marked "yes."

Did the workshop reinforce your interest in growing specialty crops?
All attendees marked "yes."

Did the workshop increase your confidence?
All attendees marked "yes." They felt better about expanding their business in direct-to-consumer markets, not only at farmers markets but to stores, restaurants and schools in their communities.

Instructors and their involvement with participants?
Attendees gave this question high marks. Participants said they felt they could interrupt the presenter with questions and were answered with the knowledge they wanted.

Stimulated thinking/interest?
Attendees marked this section with "1's" and "2's.' One participant said they may change their business idea and plan so they can strengthen it.

Delivery?
Attendees gave this area "1's" "2's" and "3's." They enjoyed the live presenters. Those who marked "3" felt that the video information was good but could not ask questions about GAPs training and social media.

Overall evaluation of workshop?
Attendees gave this area high marks, but said they would like to have a more in depth or an all day workshop so they could receive more training on business planning, enterprise budgeting,

and individual assistance using social media and email as marketing tools. They also expressed interest in an all day workshop regarding GAPs so they can assess how that could increase their sales to schools. Some expressed interest in learning how to start a CSA. One participant said they would like farm tours to see what other farmers in their area are doing.

Workshops were held in:
Kearney, Nebraska, March 8 with fourteen in attendance.
Norfolk, Nebraska, March 22 with eight in attendance.
Scottsbluff, Nebraska, May 8 with eight in attendance.

Those attending said they didn't know what enterprise planning was and wanted to know more about GAPs and how they could utilize social media to increase their business. From the evaluations, all presentations scored very well and were very informative. One webinar was presented live and recorded. It was entitled, H*ow can I be better? Introduction to basic business planning and enterprise budgeting.* As of Nov. 30, 2014, 12 specialty crop growers have viewed the webinar.

A total of 42 specialty crop growers participated in the workshops or the webinar.

Goal #3: Increase public's awareness of the availability and benefits of purchasing specialty crops and the value of buying locally.

Results of Measurable Outcome #3: Project staff measured the public's opinion on specialty crops and their purchasing habits through surveys.

Consumer Survey:
We conducted consumer surveys at a farmers market to find out what customers valued most when purchasing locally grown food direct from the grower. Surveys were scored from 1 (lowest) to 5 (highest). From the 65 surveys that were completed, we received the following information:

- Transparency/Integrity of growers: 0 marked 1, 0 marked 2, 5 marked 3, 16 marked 4 and 42 marked 5
- Quality of products: 0 marked one, 0 marked 2, 2 marked 3, 13 marked 4, and 47 marked 5
- Diversity of products: 0 marked 1, 0 marked 2, 7 marked 3, 25 marked 4, and 30 marked 5
- Vendor knowledge of products: 0 marked 1, 0 marked 2, 7 marked 3, 16 marked 4, and 41 marked 5
- Nebraska grown in-season: 0 the marked 1, 0 the marked 2, 4 marked 3, 9 marked 4, and 51 marked 5
- Certified Organic: 4 marked 1, 11 marked 2, 10 marked 3, 18 marked 4, and 20 marked 5
- Social experience: 1 marked 1, 10 marked 2, 8 marked 3, 22 marked 4, and 22 marked 5
- Face-to-face relationship with growers: 0 marked 1, 4 marked 2, 8 marked 3, 17 marked 4, and 34 marked 5
- Supporting the local economy: 0 marked 2, 0 marked 2, 1 marked 3, 6 marked 4, and 57 marked 5

- Supports a sustainable environment: 0 marked 1, 0 marked 2, 2 marked 3, 7 marked 4, and 55 marked 5
- Supports a healthy life style: 0 marked 1, 0 marked 2, 2 marked 3, 8 marked 4, and 53 marked 5.

The ages of those answering the survey ranged from 22 to 73 with the following breakdown of age demographics from the 63 answers:
- 17 in age group of 20 – 30
- 23 in the age group of 40 – 50
- 22 in the age group of 60 – 70
- 1 in the age group of 70+

Gender: 57 answers:
- 40 female and 17 male

Dollar amount spent per week? 62 answers:
- 23 reported $20 - $30
- 17 reported $40 - $50
- 5 reported $60 - $70
- 1 reported $80 - $90
- 10 reported $100 - $200
- 6 reported they didn't know or it varied from week to week

Do you purchase locally grown food at farmers market first and then shop at the grocery store? 61 answers:
- 48 marked "yes"
- 13 marked "no"

How often do you attend a farmers market? 56 answers
- 37 reported every market day
- 14 reported once a month
- 13 reported less

How far would you travel to purchase locally grown food?
- Average answer:10 – 30 miles

Where do you go to find information about local food and farmers? There were a total of 114 answers as survey attendees could mark all that applied:
- 15 reported the Newspapers
- 15 reported Email
- 31 reported Friend
- 13 reported Buy Fresh Buy Local Food Guide
- 8 reported Buy Local Nebraska website
- 2 Twitter
- 3 www.food.unl.edu website
- 12 Facebook
- 10 radio
- 5 TV

The largest age group (40 – 70) that completed the survey chose newspaper, friend, radio, and TV (61 answers).

What is your household size? 64 answered this survey question:

- 13 replied one household member
- 31 replied two household members
- 8 replied three household members
- 4 replied four household members
- 6 replied five household members
- 1 replied six household members
- 1 replied seven household members

Where do you live? 64 answers:

- 57 in Lincoln
- 6 in communities just outside of Lincoln
- 1 out of state

Beneficiaries

Current specialty crop growers were the primary beneficiaries of this project. Consumers also benefited by learning more about how their food is grown.

Lessons Learned

As stated in the Goal and Outcomes Achieved section, specialty crop growers who attended the in-person workshops expressed interest in GAPs and Social Media. Participants also wanted more in-depth workshops. In hind sight, the project may have been better able to meet these needs by offering longer, in-depth workshops versus half day courses.

The webinar attendance was not as high as anticipated, and this may be due to the nature of the material being offered. Some subjects might be more interesting at a workshop. For example, discussing business finances might be more beneficial if discussed at a workshop where participants can more easily interact with the presenter and ask questions specifically related to their operation.

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Additional Information

Videos may be viewed at the following web links:

Grow with the Flow
https://www.youtube.com/watch?v=eLOJWwq4MQI

Lakehouse Farm, Prairie Plate Restaurant
https://www.youtube.com/watch?v=ZXa_9vGkZw4

Nebraska Mushroom
https://www.youtube.com/watch?v=0wzLxdO3TiA

Oak Ridge Farms
https://www.youtube.com/watch?v=POpcJO5eu-0

Project Title

Improving Utilization of Dry-Edible Bean in Snack Food Processing

Project Summary

The overall goal of this project was to investigate ways to improve the quality of snack foods formulated with dry-edible beans and to increase the utilization of dry beans in commercial snack food processing. There were two main outcomes of this project: 1) the characterization of fractionated bean ingredients that could be valuable for snack food production, and 2) the development of an extruded bean snack product. For the first outcome, we developed a wet-milling procedure to isolate high fiber (35-46%), high starch (84-94%), and high protein (52-58%) fractions. These fractions could be useful as food ingredients. In the second outcome, we found that the addition of 15% Pinto bean flour to extruded rice puffs improved volume and textural properties of the puffs and were well liked by consumers. These results will benefit food companies that wish to produce healthy foods, as well as producers that will benefit from increased demand for their product.

Project Approach

The overall goal of this project was to investigate ways to improve the quality of snack foods formulated with dry-edible beans and to increase the utilization of dry beans in commercial snack food processing. We found that particle size of bean flour affects oil absorption. In particular, larger particle sizes have lower oil absorption. Accordingly, the method of milling affects oil absorption. The extruded snacks market is projected to reach $31 billion by 2019. Thus, we believe that our research will be valuable to food companies wishing to create a niche in this market. We anticipate that this will increase the demand for dry edible beans by creating a new market for these products.

Goals and Outcomes Achieved

There were two main outcomes of this project: 1) the characterization of fractionated bean ingredients that could be valuable for snack food production, and 2) the development of an extruded bean snack product. Originally, the goal was to develop a fried snack food containing bean flour. With the change in project coordinator, we demonstrated the application of bean flour to extruded snack foods.

In the first year of the project, we milled Great Northern and Pinto beans using hammer and jet mills. Coarse and fine flours were produced. Pasting properties and water and oil absorption capacities were tested. We focused on extrusion processing of Pinto beans and developed extruded snacks that contained Pinto bean flour. We also found that incorporation of bean flour into extruded rice puffs at 15% extruded at low moisture improved volume and textural properties of the puffs and were well liked by consumers.

Table 1. Particle size distribution of jet-milled flours.*

Milling conditions	Dv 10 (µm)	Dv 50 (µm)	Dv 90 (µm)
1 mm, 75 psi	1.6	12.5	38.1
1 mm, 85 psi	1.5	11.4	33.6
2 mm, 75 psi	1.6	14.0	122.3

2 mm, 85 psi	1.6	13.7	90.8

*Dv 10, 50, 90, indicates that 10%, 50%, or 90% of particles are below the noted particle size.

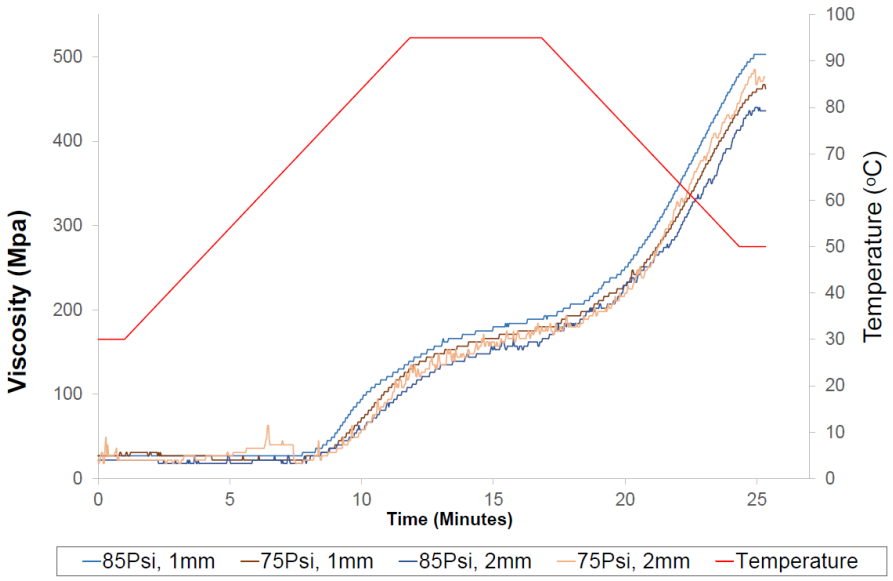

Fig. 1. Pasting profiles of jet-milled flours.

Table 2. Selected properties of jet-milled flours.

Milling conditions	Starch damage	Water solubility index	Water absorption index	Oil absorption index
1 mm, 75 psi	1.00	17.82	3.26	1.82
1 mm, 85 psi	1.43	22.04	3.15	2.10
2 mm, 75 psi	0.70	22.04	2.31	1.88
2 mm, 85 psi	0.74	26.83	2.30	1.88

In the second year of this project, we developed a wet-milling procedure to isolate fiber, starch, and high protein fractions from beans. This procedure did not require any chemicals and resulted in 3 fractions: high fiber (35-46%), high starch (84-94%), and high protein (52-58%). We focused on extrusion processing of Pinto beans. Four blends of brown rice and pinto bean flour (0%, 15%, 30% and 45% bean flour) were extruded using a pilot scale twin screw extruder under 5 moisture conditions (17.2%, 18.1%, 18.3%, 19.5%, and 20.1%). Physical properties [bulk density, true solid density, apparent density, radial expansion, axial expansion, overall expansion, specific volume, hardness, color, water solubility index (WSI), and water absorption index (WAI)] and *in vitro* starch and protein digestibility were determined. Overall expansion ratio ranged from 3.5-4.2; bulk density from 0.09-1.55 g/cm^3; and hardness from 138-196 N. Bean flour and feed moisture had significant ($p<0.05$) effects on all the physical characteristics (Fig. 1). Rapidly digestible starch (RDS) ranged from 66-75% (starch basis) and decreased with addition of bean flour (Fig. 2). RDS was also decreased when processing under higher moisture conditions. Resistant starch increase with increasing bean flour and moisture conditions. Protein digestibility increased with increasing bean flour substitution and moisture processing conditions (Fig. 3). Thus, incorporating Pinto bean flour into extruded products can negatively affect

physical attributes in terms of hardness, density, and overall expansion; however, these negative effects can be partially alleviated by adjusting the moisture conditions during processing.

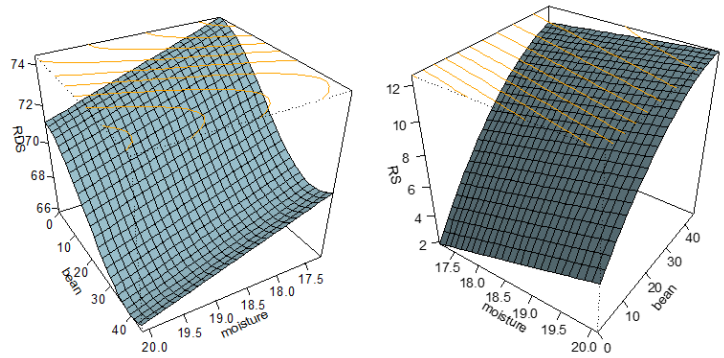

Figure 2. Effect of feed moisture and flour blend on rapidly digestible starch (RDS) and resistant starch (RS) of rice-bean ex

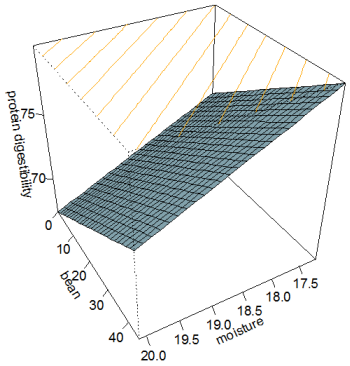

Figure 3. Effect of feed moisture and flour blend on in vitro protein digestibility of rice-bean extrudate.

Beneficiaries

The direct beneficiaries of this project were the students that received graduate training as a result of these funds. Indirect beneficiaries are food companies that have benefited from the information discovered in this project. We have presented this material in scientific conferences that are largely attended by members of the food industry. The Institute of Food Technologists (IFT) Annual Meeting was attended by 25,000 food professionals. The American Association of Cereal Chemists International Annual Meeting was attended by approximately 1,000 industry, research, and academic professionals. The presentations were targeted to the entire attendees of both meetings. (See the end of this report for the title of the scientific presentations and the peer-reviewed publications.) Several food companies have shown interest in this project. We have also shared this information with the Nebraska Dry Bean Commission, which looks for opportunities to increase the consumption of dry edible beans, educate the consumers about the health benefits of dry beans, and continue to fund research aligned with the goals of the

commission. The commission is comprised of 9 members (6 growers and 3 processors). The results of this project will potentially reach 1,700 dry-edible bean farmers who primarily reside in Nebraska's panhandle region.

Lessons Learned

This project was originally managed by another faculty member. There were a number of challenges associated with the transition of project coordinators. The first challenge was that the original intent was to develop fried snack foods from beans. However, the new coordinator did not have any experience with fried snack foods. Therefore, we changed the focus to extruded snack foods. This did not change the scope of the project, but did change the specific product we were developing.

An even more significant set-back we had was that the student on the project decided to drop out of the program. This created significant challenges that we are still recovering from. The student was in the process of developing methods to fractionate beans into valuable ingredients that could be used in foods. We were unable to advance this portion of the project as far as we intended, but will continue to work in the future to publish the results.

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Additional Information

Scientific presentations from this project:

Sumargo F, Ratnayake WS. 2014. Effects of particle size reduction by air-jet milling on the properties of *Phaseolus vulgaris* L. var. Pinto bean flour. AACC International Annual Meeting, Albuquerque, NM.

Sahasrabudhe SN, Burrows AS, Wang H, Ratnayake WS. 2014. Partial characterization of pinto bean starch extracted under selected wet-milling conditions. Institute of Food Technologists Annual Meeting, New Orleans, LA.

Sumargo F, Wang H, Rose DJ. 2015. Compositional analysis of wet-milled fractions of dry edible beans. AACC International Annual Meeting, Minneapolis, MN.

Sumargo F, Weier SA, Rose DJ. 2015. The effect of feed moisture on the physical properties and *in vitro* digestibility of extruded rice and pinto bean flours. AACC International Annual Meeting, Minneapolis, MN.

Peer-reviewed publications from this project:

Sumargo F, Gulati P, Weier SA, Clarke J, Rose DJ. 2016. Effects of processing moisture on the physical properties and *in vitro* digestibility of starch and protein in extruded brown rice and pinto bean composite flours. Food Chemistry 211:726-733.

Gulati P, Sumargo F, Wang H, Rose DJ. Composition and *in vitro* starch digestibility of wet-milled dry edible bean (*Phaseolus vulgaris*) fractions. *in preparation*.

Project Title

Extending the Season and Increasing Farmer Income in Southeast Nebraska

Project Summary

Interest in locally-grown, direct-marketed specialty crops in the United States is exploding. Not only are more farmers markets opening every year, but winter markets make up over 20% of markets listed in the USDA's National Farmers Market Directory. There are 103 farmers markets in Nebraska, and many have expanded their season to cover six months of the year. However, very few of these markets operate in the winter. Specialty-crop growers in Nebraska are missing out on this large, untapped market, forcing consumers to buy produce from outside the state and even outside of the country. There are three primary reasons for this. First, growers don't know enough about season extension methods and crop varieties to consistently produce in the winter. Second, the marketing infrastructure does not exist in the winter as it does in the summer. Third, few growers have the capital to invest in season extension equipment like hoop houses. This project proposed to address all three issues.

Project Approach

First, Community Crops offered a series of workshops in the late fall on season extension methods. These workshops covered the basics of equipment, crop timing, and varieties particularly suited to winter production in Nebraska. A farm tour was offered at the Crops demonstration farm, where produce was growing for the 100 member winter CSA. Farmers in the area were able to see first-hand how the materials and techniques were put into practice. In addition to growing cold-tolerant vegetables, workshops also covered proper post-harvest handling and storage for long-term storage crops like sweet potatoes, winter squash and root vegetables. Second, Community Crops partnered with the Old Cheney Road Farmers Market and Open Harvest to organize a Holiday Harvest Farmers Market in Lincoln. This market benefited existing growers while encouraging beginning growers to adopt season extension techniques. It also highlighted the farmers that are using season extension tools and their specialty crops. Finally, this project connected growers with public and private funding sources for season extension tools as well as access to the Community Crops Season Extension Library.

Timeline of Events

October 2013 – June 2015: Helped producers purchase season extension products. We advised on season extension at Prairie Pines and then later for producers in SE Nebraska.

October 2013: Started planning Holiday Harvest Farmers Market, started Promotion to public.

October 2013 – June 2015: Installed Crops Season Extension Library.

October 2013: Planned demonstration plots and advertised for HHFM.

November 2013: First Holiday Harvest Farmers Market.

January 2014: Collected data from HHFM and picked dates for 2014 markets.

March 2014: Season Extension Workshops hosted by Darlin Reds and Fox Run Farms.

March 2014: Farmers at Prairie Pines started producing with row covers and cold frames.

March 2014: Installed demonstration plot. Fixed cold frames for production.

March 2014 – November 2014: Continued to demonstrate season extension practices to farmers.

October 2014 Started planning season extension plots for 2015.

November 2014: Advertised for HHFM.

March 2015: Purchased season extension supplies and hosted workshops.

April 2015: Repaired cold frames from winter damage.

Goals and Outcomes Achieved

Organize and host hands-on season extension workshops.
A season extension workshop was held on Saturday, March 15, 2014, at two local small-scale specialty crop farms. The Darlin' Reds hosted the morning session and Fox Run Farms hosted the afternoon session. Both locations provided a farm tour and a discussion regarding season extension practices.

Work with growers to develop crop plans and business plans for winter production.

Community Crops had the eight farmers in our incubator site complete plans for extending the season. Among those farmers, one farmer prepared for the 2014 Holiday Harvest Farmers Market and 5 participated in late-season markets. All but one of the farmers started crops early in the year by using row covers and cold frames. These season extension tools allowed them to pursue early and late-season markets. We have continued this work in 2015, and have been helping our participating farmers prepare solid plans for growing for the 2015 Holiday Harvest Farmers Market.

Organize and run a Holiday Harvest Farmers Market in November 2013.

High interest and demand for late-season, specialty crops was demonstrated at Lincoln's first winter market in November 2013. More than 1,800 customers attended the Holiday Harvest Farmers Market, an event that happened because of a partnership with Community Crops, Old Cheney Road Farmers Market (OCRFM), and Open Harvest Cooperative Grocery. A total of 12 farmers and four processors reported $14,500 in sales from that market. However, demand for specialty crops exceeded the supply, and all twelve farmers selling at the market sold out of produce.

Install the Community Crops Season Extension Library. The library would be done by the completion of the classes allowing farmers to rent them to extend their seasons.

A number of season extension tools and books were purchased for farmers to check out. These were made available during the classes and throughout the year to local specialty crop growers. Four farmers checked out the equipment for their use. These farmers used the tools to create hoop houses allowing them to extend their season. We continue to promote the Season Extension Library in classes and in workshops.

Help growers purchase season extension products. (October 2013 to June 2015)

Staff provided one-on-one assistance to farmers to help them choose appropriate season extension tools. During the workshops, staff was able to answer many questions about season extension methods, where to purchase materials, and resources to utilize. Farmers were also shown ways they can extend their season with new construction tools and items they may already own. This allowed farmers to find season extension tools that would fit their budget. We had 31 farmers attend our workshop classes and of those who had access to land, 11 extended their season. These 11 farmers had individualized plans that varied from early planting in the spring to farming past the first killing frost in the fall.

Organize and install demonstration plots. The plots would be installed and available for demonstrations October 2013 to September 2014.

Crops installed several demonstration plots to show farmers how season extension should be carried out. Starting in the spring of 2014 we installed row covers and cold frames to demonstrate their benefits. Starting in June 2014, we started planning our fall demonstration plots. These plots were put into place in August of 2014. We had 4 farmers who used the demonstration plots to set up their own season extension practices. In 2015, we continued to demonstrate season extension methods, both in the field and in our hoop house.

It was anticipated that 15 farmers would create and carry out a winter production plans to successfully grow late season specialty crops (an additional $60,000 worth of specialty crops). We are currently tracking progress toward this outcome and will gather data after the 2015 winter growing season. Thus far, we have had 11 growers work on season extension methods.

Beneficiaries

The beneficiaries of this project were the specialty crop growers who were able to improve their skills, expand their equipment and increase their income during this project and beyond.

Consumers benefited, as well, by being able to purchase local produce for an extended season. This funding also created a strong partnership between three local organizations, which included Community Crops, Open Harvest, and the Old Cheney Road Farmer's Market. This resulted in many new collaborative projects, such as a series of cooking workshops highlighting specialty crops.

Finally, this initial funding showed that a late season market could be successful in the Lincoln area. Additional funding from the Nebraska Environmental Trust and Specialty Crop Block Grants has continued this process, resulting in three late season market dates to be held in 2015. This expanded opportunity will continue to benefit producers and consumers for many years to come.

Lessons Learned

While all of our farmers at Prairie Pines had intentions of extending their season through November of 2014, only three were actually able to complete that goal. The ones that were not able to complete their goals found that new babies, new jobs and health problems set them back. Outside the incubator farm, many new farmers found the same problems challenged them. We also had to overcome current farmers attitudes against season extension methods. Farmers are accustomed to working less during the winter months and prefer not to pursue season extension practices. In our Growing Famers Workshop Series, we are teaching growers how to store their crops and various season extension techniques. By utilizing a combination of the two techniques, farmers can find ways to extend their season that works best for them.

We are also working on promoting our Season Extension Library to more farmers throughout the state. We will continue to talk about it to new farmers at various educational events.

Contact Information

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Project Title

Reducing / Eliminating Chemicals Used in Tomato Production

Project Summary

The purpose of this project was to determine whether spraying tomatoes and their vines with ozonated water would control and/or eliminate diseases better than would typical chemical pesticide usage. Should it be determined that disease control could be realized with a chemical free or chemically-reduced process, this project could potentially impact every specialty crop producer in the state of Nebraska.

Project Approach

Task #1. (February 2014): Project team (including representatives from Steinbrink Nursery, Mac's Creek Winery, Ozone Consultant, and Research Consultant) met to outline the overview and details of the project. Decisions were made thereby integrating the Goals and measurable Targets of the project with the "typical real world" production of tomatoes (e.g., variety of tomato best suited for the area, typical chemical spraying schedule, locations of plots to minimize any carryover/drift from other areas of nursery, ozone spray schedule, etc.)

Task #2. Tomato seedlings were started in the greenhouse. One type of tomato was started (rather than three which was proposed) to focus on the one most robust variety typically grown in this area, and, to enable the project to expand beyond what was proposed by experimenting with differing rates of application of ozone (i.e., three different rates rather than just two which was originally proposed).

Task #3. (June 2014). Due to adverse weather conditions, planting was delayed until June 19th. Sixty plants (increased from the 36 originally proposed) of the one type of tomato (Better Boy) were transplanted at the outdoor site at the nursery. Blocks of 12 were planted (two rows of six plants planted side by side). All plants were caged. All plants were under drip irrigation. All plants had a ring of grass clippings placed around them one week after planting. Five rows (12 plants each) were divided as follows:

Row 1 – sprayed with ozone every week.
Row 2 – sprayed with ozone every other week.
Row 3 – sprayed with ozone every third week.
Row 4 – sprayed with chemicals typically used (copper fungicide) for treating disease (blight) on tomatoes
Row 5 – controls (no spray of any kind)

Task #4. (April – May, 2014). Research assistant (provided by research partner Steinbrink Nursery) was trained in the research protocol and specifically trained to rate disease and use the Observation Rating Scale. Approximately 10% of the practice ratings were randomly selected and rated by a second observer (Steinbrink Horticulturist) for reliability check (inter-rater reliability >90% agreement).

Task #5. (June – September 2014). Ozone spraying began on July 2nd, and continued through September 10th, according to the previously described protocol schedule. Chemical spraying (Row 4) was done on August 7th and September 4th as per typical protocol of the Steinbrink

Nursery, in raising tomatoes. Disease pressure was relatively light and thus chemical spraying was deemed necessary once every 30 days as opposed to once every 10 days as proposed.
Task #6. (July – September 2014). All plants were scouted for disease on a weekly basis. Ratings were made as to disease pressure weekly using the Observation Rating Scale. Moreover, each plant was measured for height four different times throughout the growing season. Additionally, the total weight (by row/research group) was recorded at the time of harvest.

Task #7. (August – September 2014). A demonstration "Field Day" was being planned for late August/early September in invite tomato growers and other interested parties for demonstration, observation and discussion of project results. However, severe storms in late August severely damaged plants such that Field Day planning was cancelled.

Task #8. (January 2015). A proposal for presentations of project results (including data analysis, photos of tomato plants, discussion of project and results to be presented by project partners [Steinbrink Horticulturist, Mac's Creek Ozone Consultant and Research Coordinator) was accepted for presentation at the GPGC in St. Joseph, Missouri, January 8 – 10, 2015. However, the conference coordinators encountered scheduling conflicts and subsequently the presentation was cancelled.

Year 2

Task #1: Complete data analyses. All data analyses have now been completed.

Task #2: Present project findings at the GPGC in St. Joseph, Missouri, in January 2015.
Due to scheduling changes made in reference to the GPGC in January 2015, we were unable to make the projected presentation. However, we were able to re-schedule and presented the project and its results at the GPGC in January 2016 (see Task #4).

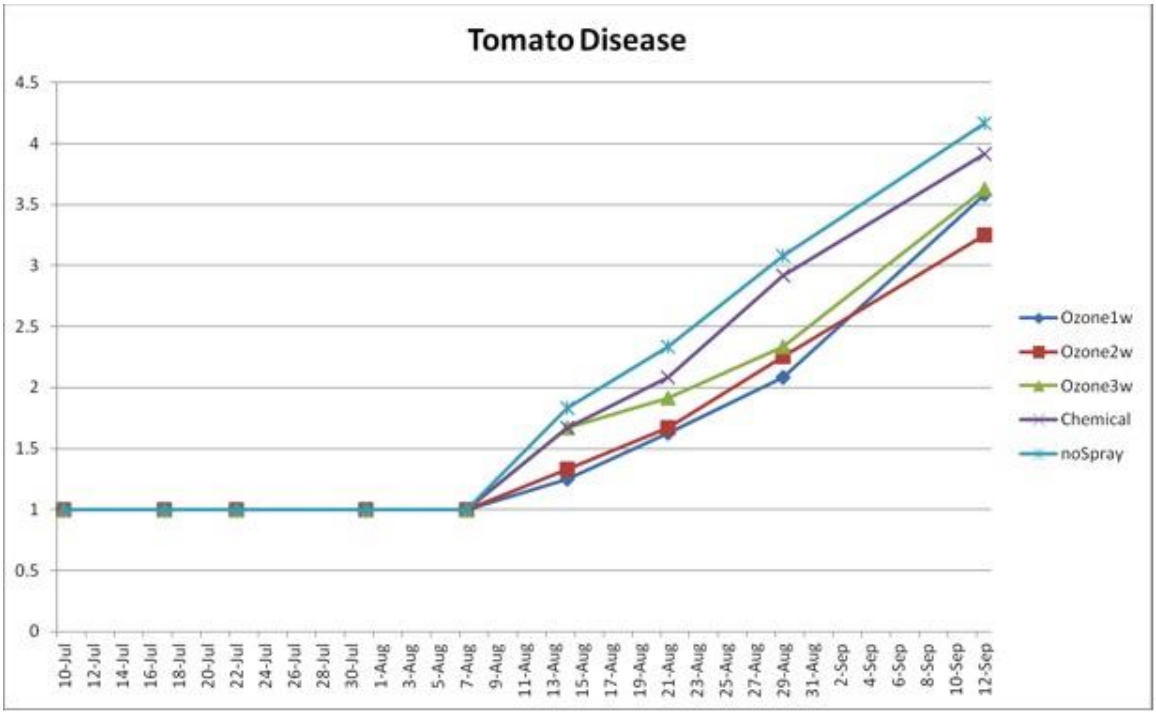
Task #3: Submit expenses for reimbursement.
All expenses have been submitted and reimbursement has been received.

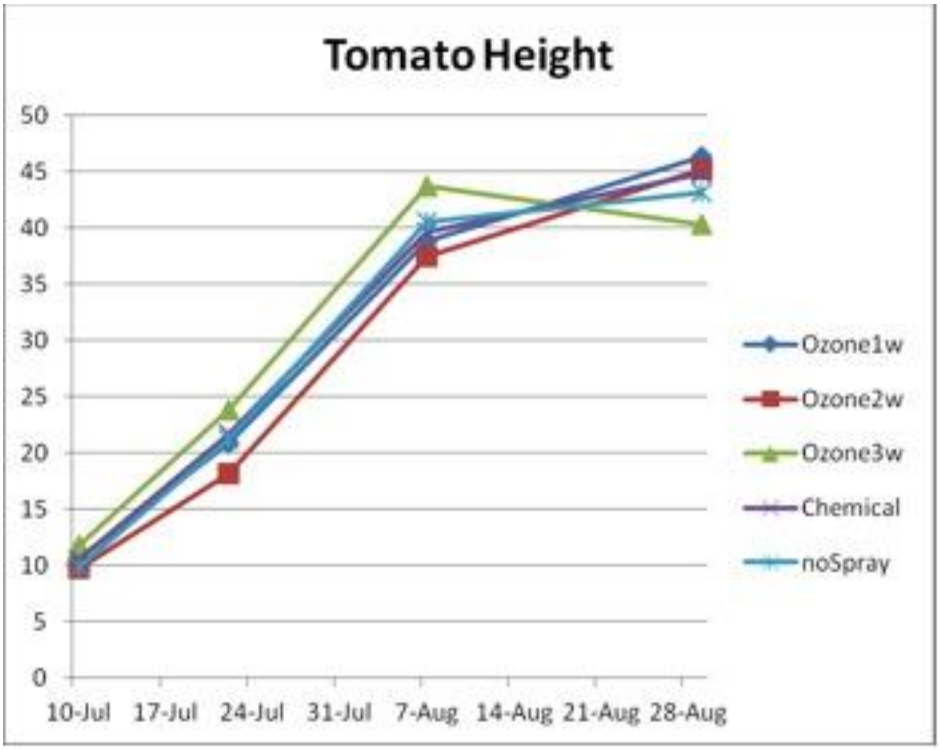
Task #4: Project results (including data analysis, photos of tomato plants, discussion of project and results were presented by project partners [Steinbrink Horticulturist, Mac's Creek Ozone Consultant and Research Coordinator) at the GPGC in St. Joseph, Missouri, January 8 – 10, 2016. Approximately 55 growers from across several states (Missouri, Kansas, Iowa, Nebraska) were in attendance. A lively discussion followed the presentation which raised significant questions as to whether the efficacy could be safely replicated in a confined greenhouse and/or high tunnel application. Consequently, these questions have been addressed in another SCBG research study which has been accepted and will begin November 1, 2016.

Goals and Outcomes Achived

Goal #1: Produce healthy disease-free plants without using chemicals. Target established for this goal was to set to have the ozone-treated plants rated $\leq$ 3 points on the Observation Rating Scale (rated on a 1-no disease to 5-lethal disease pressure, scale). Disease ratings were made weekly (i.e., 9 weekly ratings), which has provided the data to address this target. Moreover, plant height (as a performance measure of plant health and vigor) measures were also collected on four dates. Additionally, total harvest weights for each row/group were taken (as another performance measure of plant health and vigor). Each of these types of data provide evidence

(multiple perspectives) of degree of attainment of the target for goal #1. The results of these data analyses are as follows:





GROUP	TOTAL WEIGHT
CONTROL (no spray)	75.50
CHEMICAL SPRAY	84.00
OZONE (1 week)	91.50
OZONE (2 week)	86.75
OZONE (3 week)	74.00

All tomato plants were started in the greenhouse and were transplanted to the outdoor research setting in late June. Groups were adequately seperated in order to assure minimal or no drift of spray applications across groups. Vines were scouted each week for disease and rated on the Observation Rating Scale. Plants were rated 1-5 (1= No observable disease; 5 = high disease pressure).

As can be seen, little or no disease was detected through July. During the month of August there were several rain storms with high winds that blew over the caged vines. Heavy rainfall caused dirt to be splashed from the ground onto the leaves of the plants. It was after these storms when the plants started to show signs of disease pressure. Results were as follows:

1. Ozone treated vines were consistently rated as having significantly less observable disease than Control (no treatment group).

2. Ozone treated vines were consistently rated as having significantly less observable disease than chemical sprayed vines.

3. No differences in ratings were found between Control (no treatment group) and Chemical sprayed vines.

4. While differences in growth (size) of tomato vines were observed, these were not found to be significant.

5. Differences in total weights at harvest were reported.

These data should be considered as preliminary at best. That said, these results are extremely encouraging. Ozone treatment consistently applied across the six-nine weeks, documented significantly less disease pressure than the untreated controls and the vines sprayed with pesticides. Even during the time span of the most observable disease pressure (August) as observed with both the Controls and Chemically treated vines, the ozone treated vines continued to exhibit minimal presence of disease ranging from no to moderate disease pressure. These data are consistent with previous research in showing positive effects on disease control (primarily Downy Mildew) when used on grapevines.

An additional and somewhat alarming finding suggests that across the rating periods, chemical pesticides commonly used in the tomato specialty crop industry (i.e., copper fungicide) show little if any effect as measured by rater's observation of disease pressure. Disease pressure was rated at levels equal to the Control group which received no treatment at all. This finding could be indicative of the build-up of chemical resistance, which has become so pervasive in the usage of pesticides.

Additional research is necessary to replicate these findings across multiple years (i.e., differing weather conditions from summer to summer), multiple specialty crop sites (and thus microclimates throughout Nebraska), and across multiple cultivars. Research is also needed to investigate varying volumes of application and intervals to incur equal disease control.

Goal #2: Dissemination of project results, implication, application and potential impact to specialty crop producers across Nebraska. The target set for this goal is to educate a minimum of approximately 20 tomato growers on the results of this project. This was proposed to be accomplished via two activities:

1. Conduct a "Field Day" at Steinbrink Nursery consisting of a "hands on" demonstration. This Field Day was cancelled.

2. Present results at the GPGC and members of the Nebraska Fruit and Vegetable Growers Association. The proposal was accepted and the conference presentation was made in January 2016. Project results (including data analysis, photos of tomato plants, discussion of project and results were presented by project partners [Steinbrink Horticulturist, Mac's Creek Ozone Consultant and Research Coordinator) at the GPGC in St. Joseph, Missouri, January 8 – 10, 2016. Approximately 55 growers from across several states (Missouri, Kansas, Iowa, and Nebraska) were in attendance. A lively discussion followed the presentation, which raised significant questions as to whether the efficacy could be safely replicated in a confined greenhouse and/or high tunnel application. Consequently, these questions have been addressed in another SCBGP research study, which has been accepted and will begin November 1, 2016.

Beneficiaries

The impact of this research project could have a large impact on the tomato industry. Examples include the following.

1. Should ozone prove to effectively control disease, the grower could eliminate or reduce a substantial portion of their chemical spray program. This economic impact could increase the competitiveness of the industry.

2. Problems of disease control, the build-up of chemical resistance, chemical residual in the soil and garden, not being able to spray at or during harvest could be minimized or eliminated.

3. Improved safety and image of safety for the consumer could significantly impact the marketing/sales of Nebraska specialty crops.

4. Improved food product safety for the consumer could directly also impact the marketing and sales of the Nebraska specialty crops.

Benefits to the ecology could be as positive and significant as well. These benefits are multi-faceted.

1. Reduced build-up of disease resistance to chemicals. The build-up of disease resistance to currently used chemicals is a major problem today in production agriculture. Even with alternating the use of chemicals, resistance to herbicides, fungicides and insecticides develops. The use of ozone will not result in any such known resistance build-up.

2. Reduced usage of toxic chemicals.

3. Reduced chemical residual build-up in soil and/or water supply and increased consumer and product safety.

Benefits to Nebraska specialty crop producers could also be multifaceted and include the following:

1. Move more closely to organic production. With the elimination or reduction of the use of chemicals in the production of the food product (tomatoes in this case) the producer will move more closely to an "organic" method of production.

2. Safer raw product. The industry has done a good job of training/informing producers such that hopefully all products being used are labeled for usage with tomatoes and the application of the products are within safety and legal parameters. However, even with these safeguards in place, the continued and increased usage of these practices is resulting in the ever-increasing concern that these chemicals are potentially harmful to the environment and consumers.

3. Flexibility for disease control at the time of harvest. Pesticides use recommended "harvest intervals", which is the amount of time the grower must wait after application until the tomatoes can be safely harvested - when the disease pressure is heavy, pesticides application can be restrictive. If sprayed, tomatoes must be left hanging on the vine until the harvest interval has passed. Delayed harvest can result in poor tomato quality. Using ozone spray for disease control can be done immediately prior to harvest with no harvest interval being necessary.

Lessons Learned

1. As a result of project partner consultation, it was determined that it would be more beneficial to investigate the effects of varying applications of ozone rather than multiple types of tomatoes. Therefore, the protocol was changed from three types of tomatoes to one type (Better Boy) and from two groups of application to three groups (i.e., Row 1 sprayed every week; Row 2 sprayed every two weeks; Row 3 sprayed every three weeks).

2. Due to increase number of research groups (total of five groups (rows), multiple raters of disease and reliability checks by horticulturist, and, multiple research assistants spraying ozone on differing rows on differing weeks, it was decided to explicitly label each row to minimize confusion and potential contamination of data collection, Therefore, the protocol was changed and the Research Assistants were not kept blind as to the Group (Row) identification.

3. Due to severe storms hitting the research plot and blowing the plants over onto the ground, the Field Day (Task #6) was cancelled.

4. Due to the inclement weather at the beginning of the project, the outdoor planting of the tomato plants was delayed until June 19, 2014. Adequate data collection was possible. However, one of the Expected Measurable Outcomes (i.e., ozone treated plants blooming earlier) could not be accurately measured due to the shortened growing season. A related Expected Measurable Outcome (i.e., ozone treated tomatoes being more productive) were addressed by comparing total weights of tomatoes harvested.

Contact Information

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Project Title

VitiNord – International Cold Climate Viticulture Conference

Project Summary

This project was designed to develop a partnership among the Nebraska Winery and Grape Growers Association, Nebraska Grape and Winery Board, Nebraska Department of Agriculture, University of Nebraska – Lincoln Department of Agronomy and Horticulture, University of Nebraska – Lincoln Viticulture Program, and Nebraska Tourism Commission in order to host the International Association for Northern Viticulture's (IANV) cold climate conference. This conference, entitled "VitiNord," brought the world of viticulture to Nebraska. Two hundred twenty eight (228) researchers, viticulturists, and wine industry supporters from all around the world descended upon Nebraska for several days of sharing best practices to greatly enhance the state of the industry and bring world attention to not only the industry worldwide, but specifically, to the developing prominence and industry leadership emanating from Nebraska. The purpose of this project was two-fold. The first was the promotion and development regarding global collaborative research in the area of viticulture in northern environments, and the second the promotion of Nebraska's tourism industry by hosting the 2015 VitiNord Conference.

Project Approach

Year 1

Task #1. Determine conference dates and select conference location. (October – November 2013): Project Coordinator and members of IANV met via video conference and selected the dates and location of the conference. It was held November 11 – 14, 2015, at the Lied Lodge and Conference Center in Nebraska City, Nebraska.

Task #2 and #3. Hire Conference Coordinator and Recruit Conference Committee Chairpersons. (November – December 2013): Project Coordinator and members of IANV determined that planning of an internationally impactful conference of this magnitude could better be accomplished by a multi-perspective collaborative committee (i.e., Conference Planning Committee [CPC]) rather than an individual conference coordinator. As such, this committee was formed with the following positions being filled:

- CPC Coordinating Chairperson (Nebraska)
- Scientific Program Committee (Minnesota and Wisconsin)
- Social Program Committee (Nebraska)
- Marketing and Communications (Nebraska)
- Exhibitors and Trade Show (Nebraska)
- Promotions (Illinois and Canada)

Task #4. Establish Conference Planning Timeline. (January 2014): With the CPC in place, the first CPC meeting was held on the conference site in Nebraska City, Nebraska, January 3 – 5, 2014. Conference timelines, master plan, and other conference details were planned.

Task #5. Distribute Pre-Conference Marketing Materials. (January – October, 2014): The conference website went "live"; preliminary schedule was disseminated; keynote speakers were

secured; session speakers (international and national) were recruited; call for presentations was disseminated; contracts with conference hotel was confirmed; and the pre-conference tour was planned. The CPC was expanded to include two additional positions -- Treasurer and Sponsorship Coordinator.

Year 2

Task #1: Host a second Conference Planning Committee (CPC) in Nebraska City, Nebraska, November 21 – 23, 2014. Details of the conference were finalized, which included, but were not limited to:

1. Developed a conference evaluation rating scale;
2. Identified speakers;
3. Organized trade show format;
4. Set-up facility rental and meeting spaces;
5. Coordinated attendee registrations;
6. Reviewed and discussed social program activities;
7. Addressed conference's scientific program content; and
8. Identified future promotional events and efforts.

All CPC members were in attendance for the meeting. A comprehensive and ambitious agenda was used to guide the furthering of the planning for all conference components listed above. With less than 12 months until the conference itself, final year planning details were identified for each conference component to be addressed and reported back to the CPC as a whole via emails, phone conferences, and video conference meetings leading up to VitiNord 2015.

Task #2: Host the 2015 VitiNord Conference November 11 – 14, 2015.

The fourth tri-annual VitiNord was held in Nebraska City, Nebraska, from November 11 – 14. The conference drew 228 participants from 10 countries (Germany, Estonia, United Kingdom, Sweden, Denmark, Canada, USA, Finland, Norway, Switzerland) and 21 states (Iowa, Minnesota, Alaska, California, Montana, North Dakota, South Dakota, Missouri, Vermont, Kansas, Nebraska, Pennsylvania, Ohio, New York, Colorado, Indiana, Wisconsin, Illinois, Michigan, Maine, Wyoming). For a complete review of the entire conference schedule, events, sponsors, trade-show, etc. please refer to the VitiNord web site (www.vitinord2015.org).

Task #3: Evaluate conference objectives via a conference rating scale. Record number of attendees and disaggregate by country/state of residence.

A Conference Evaluation Form was developed by the CPC to be used to evaluate conference efficacy and objectives. The evaluation form was sent out electronically (via Constant Contact) to all conference participants.

The 228 conference participants have been disaggregated by country/state of residence.

Task #4: Analyze conference evaluation data. The Conference Evaluation Form was sent out after the conference (November 2015) and data was collected until the end of December 2015. Analysis of conference evaluation data occurred in January 2016.

Knowledge/satisfaction gained from conference was measured.

The goal of this project, which was to increase the knowledge of attendees on cold weather viticulture, was completed. To measure this goal, a post-conference evaluation was conducted. Forty-nine surveys were returned representing an approximate 21% return rate. Ratings of satisfaction with various components of conference were rated as follows:

1. Keynote Sessions = 4.5
2. General Sessions = 4.4
3. Parallel Sessions = 4.4
4. Viticulture Strand = 4.4
5. Enology/Winery Strand = 4.3
6. Poster Sessions = 3.9
7. Wine Tasting Sessions = 4.4

These ratings ranged from 3.9 – 4.5 with an overall average rating of 4.33 on a 5 point scale (1 = Very Dissatisfied ; 5 = Very Satisfied).

Ratings of overall impressions of the conference components:

1. The keynote sessions were relevant and useful = 4.5
2. I can put what I learned to immediate use = 4.3
3. The speakers were knowledgable and dynamic = 4.4
4. The sessions met my expectations = 4.3
5. The conference met my expectations = 4.5

These ratings ranged from 4.3-4.5 with an overall average rating of 4.4 on a 5 point scale (1 = Strongly Disagree; 5 = Strongly Agree).

Goals and Outcomes Achieved

1. Expected Measureable Outcome was for Nebraska to organize, plan and execute a three-day conference. Nebraska successfully organized, planned and executed

a three-day conference to disseminate information to world leaders about the successful pursuit of cold climate grape and wine production.

2. The goal of this project was to increase the knowledge of attendees on cold weather viticulture. No benchmark existed. It was anticipated that 80% of respondents would report an increase in the knowledge of the topic (target). The knowledge was measured by post conference evaluations.

Year 1

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- CPC Coordinating Chairperson (Nebraska)
- Scientific Program Committee (Minnesota and Wisconsin)
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Year 2

Task #1: Host a second Conference Planning Committee (CPC) in Nebraska City, Nebraska, November 21 – 23, 2014. Details of the conference were finalized, which included, but were not be limited to:

1. Developed a conference evaluation rating scale;

2. Identified speakers;

3. Organized trade show format;

4. Set-up facility rental and meeting spaces;

5. Coordinated attendee registrations;

6. Reviewed and discussed social program activities;

7. Addressed conference's scientific program content; and

8. Identified future promotional events and efforts.

All CPC members were in attendance for the meeting. A comprehensive and ambitious agenda was used to guide the furthering of the planning for all conference components listed above. With less than 12 months until the conference, final year planning details were identified. Each conference component was addressed and reported back to the CPC via emails, phone conferences, and video conference meetings leading up to VitiNord 2015.

Task #2: Host the 2015 VitiNord Conference November 11 – 14, 2015. The fourth tri-annual VitiNord was held in Nebraska City, Nebraska, from November 11 – 14. The conference drew 228 participants from 10 countries.

For a complete review of the entire conference schedule, events, sponsors, trade-show, etc. please refer to the VitiNord web site (www.vitinord2015.org).

Task #3: Evaluate conference objectives via a conference rating scale. Record number of attendees and disaggregate by country/state of residence.

The conference drew 228 participants from 10 countries and 21 states. Below is a breakdown of participants per country and state.

Country

USA	=	191	Sweden	=	2
Canada	=	20	Germany	=	3
Denmark	=	4	Norway	=	1
Estonia	=	3	Switzerland	=	1
Finland	=	2	UK	=	1

State

Alaska	=	1	Michigan	=	3
California	=	3	South Dakota	=	5
Indiana	=	1	North Dakota	=	20
Colorado	=	1	Montana	=	9
Wyoming	=	1	Missouri	=	11
Illinois	=	6	Vermont	=	2
Iowa	=	7	Pennsylvania	=	1
Minnesota	=	19	New York	=	6

Wisconsin	=	10	Ohio	=	1
Kansas	=	10	Nebraska	=	72
Maine	=	1			

Task #4: Analyze conference evaluation data. The Conference Evaluation Form was sent out after the conference (November 2015) and data were collected until the end of December 2015. Analysis of conference evaluation data will occurred in January 2016.

Knowledge/satisfaction gained from conference was measured. To measure this goal, a post-conference evaluation was conducted. Forty-nine surveys were returned representing an approximate 21% return rate. Ratings of satisfaction with various components of conference were rated as follows:

1. Keynote Sessions = 4.5
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7. Wine Tasting Sessions = 4.4

These ratings ranged from 3.9 – 4.5 with an overall average rating of 4.33 on a 5 point scale (1 = Very Dissatisfied ; 5 = Very Satisfied).

Ratings of overall impressions of the conference components:

1. The keynote sessions were relevant and useful = 4.5
2. I can put what I learned to immediate use = 4.3
3. The speakers were knowledgable and dynamic = 4.4
4. The sessions met my expectations = 4.3
5. The conference met my expectations = 4.5

These ratings ranged from 4.3-4.5 with an overall average rating of 4.4 on a 5 point scale (1 = Strongly Disagree; 5 = Strongly Agree).

Beneficiaries

Mac's Creek Vineyards and Winery provided oversight for the execution of the entire project. Mac's Creek personnel served in roles of Conference Planning Committee Chairperson, Marketing and Communications Chairperson, and Exhibitors and Tradeshow Chairperson.

IANV provided expertise and experience from previous VitiNord Conferences. Three original IANV/VitiNord "Founding Fathers" served on the CPC. One is the Scientific Program Chairperson and the other two are co-chairing the Promotion Committee.

Below are additional project partners who supported this project:

- Nebraska Winery and Grape Growers Association – Executive Director is CPC member; 25 NWGGA members served as volunteers; NWGGA was financial sponsor.
- Nebraska Tourism Commission – served on CPC committee, "in-kind" sponsorship to provide marketing materials, touring buses.
- Nebraska Grape and Winery Board – multiple members on CPC; financial sponsor.
- University of Nebraska Department of Agronomy and Horticulture – assisted with Poster Sessions, organized selection of Nebraska wines to feature at conference.
- Nebraska Department of Agriculture – served as member of CPC.

The partnerships of IANV, otherwise known as VitiNord, collaborated to address the stated goal of this project by focusing on the specific conference objectives:

1. Disseminate information about the successful pursuit of northern viticulture to a wide audience;

2. Bring together enthusiasts, grape breeders and researchers to share viticulture knowledge across international boundaries through conferences, printed literature, or electronic exchange;

3. Initiate and support research and investigations that will lead to greater success and opportunities for northern viticulture;

4. Work to expand the opportunities for northern viticulture as a hobby or commerce by stimulating research and exchange of information about the use of northern grapes in winemaking, fresh consumption, and other uses;

5. Significantly heighten the awareness of the grape and wine industry in Nebraska and the state's national and world leadership prominence in the advancement and sustainability of the cold climate grape and wine industry.

Lessons Learned

1. Project Coordinator and members of IANV determined that planning of an internationally impactful conference of this magnitude could better be accomplished by a multi-perspective collaborative committee (i.e., Conference Planning Committee [CPC]) rather than an individual conference coordinator. As such, this committee was formed with the following positions being filled:

   CPC Coordinating Chairperson (Nebraska)
   Scientific Program Committee (Minnesota and Wisconsin)
   Social Program Committee (Nebraska)
   Marketing and Communications (Nebraska)
   Exhibitors and Trade Show (Nebraska)

Promotions (Illinois and Canada)

2. The original contractual component, which included paying five international speakers a flat rate of $2,000 for a total of $10,000 was proving to be unworkable. It did not allow ample flexibility to cover travel costs for more speakers at a lower and variable amount .

Contact Information

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