

Specialty Crop Block Grant Program—Farm Bill

CFDA: 10.170

AMS Agreement #12-25-B-1469

Minnesota Department of Agriculture

Agricultural Marketing and Development Division

Project Coordinator:

Julianne LaClair, Grants Specialist, 651-201-6135, julianne.laclair@state.mn.us

2015 Final Report for Federal Fiscal Year 2012 Projects

Date Submitted: 12/28/15 Revised: 1/12/15 Revised: 1/20/15

Table of Contents:

Project 1. Expanding Specialty Crop Management Education	2
Project 2. Assessing the role of soybean aphid as a vector of PVY in MN seed potatoes	6 7
Project 3. Market Expansion for Minnesota Grown Specialty Crops	43 46
Project 4. Farm to Child Care: Opening New Markets for MN Specialty Crops Final Report submitted in 2014 Annual Report, Included for reference	51 53
Project 5. Producing Strawberries with a Small Environmental Footprint Final Report submitted in 2014 Annual Report, Included for Reference	56 60
Project 6. GAPs for Vegetable and Fruit Growers: Cultivating a Peer Education Network Final Report submitted in 2014 Annual Report, Included for reference	74 78
Project 7. The Minnesota High Tunnel Network	85 89
Project 8. Promoting MN Specialty Crops to Wholesale Markets, Institutions & Consumers Final Report submitted in 2013 Annual Report, Included for reference	91 98
Project 9. Learn Life-long Healthy Cooking at your Farmers' Market	108 115

Project 1

MN Specialty Crop Block Grant FINAL PERFORMANCE REPORT

Submitted by: Minnesota Fruit & Vegetable Growers Association (Marilyn Johnson)

e-mail & phone number: mfvga@msn.com, 763-434-0400

Date: November 30, 2015

PROJECT TITLE

1. Expanding Specialty Crop Management Education Using Regional Hands-on, Interactive Workshops and One-on-One Producer Follow-up Utilizing Advanced Communication Technologies

PROJECT SUMMARY

2. Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

Local foods are gaining more market share. The number of farmers' markets in Minnesota has increased substantially in recent years as has the number of farms offering consumers a "share" of the farms' bounty through Community Supported Agriculture (CSA) programs. The number of schools participating in the Farm to School program has also increased dramatically.

To effectively and efficiently meet demand, specialty crop producers in Minnesota needed in-depth instruction. Due to cuts in funding, traditional educational programming is becoming increasingly limited or is no longer available. Most specialty crop producers have a strong need for education, but small acreages and limited resources don't allow for extra dollars to invest in college credit. We partnered with the Central Lakes College Agricultural and Energy Center and experienced specialty crop instructors to provide education and support to equip Minnesota's specialty crop producers with the skills necessary to achieve greater production and marketing success.

To meet the increasing demand for local produce for both fresh market and wholesale buyers, specialty crop producers must use effective and updated management techniques to consistently produce quality products. Traditional educational programming is becoming limited or is no longer available to specialty crop producers. Credit based management programs are becoming more expensive as tuition costs dramatically increase. Growers may have access to a wide range of information through the internet and journals, but finding the technology and matching it to their specific needs requires significant computer skills and time. Conferences were available, but typically provided a variety of short sessions geared to more experienced growers that can be difficult to integrate into an individual management system, especially for the beginning grower.

3. Establish the motivation for this project by presenting the importance and timeliness of the project.

The purpose of this project was to help new and experienced growers develop skills and knowledge to effectively produce and market their crops by providing intensive instruction on essential technical production and marketing topics. MFVGA has offered day-long beginning grower workshops and this project allowed us to help those growers further develop their skills and increase their chances of success. As the demand for locally produced food increases and more fruit and vegetable growers are looking towards retirement, the need to strengthen new growers and give them a better opportunity to succeed also increases.

Based on a credit format through the Central Lakes College Agricultural and Energy Center, program delivery was a series of full-day interactive workshops and tailored follow-up based on individual knowledge and skill level.

4. If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

This project does not build on a previously funded SCBGP or SCBGP-FB project, but it does build on previous work with the Specialty Crops Management Program which was most recently housed at Northland Community and Technical College until June 30, 2012. This project allowed the program to be officially transferred to the Central Lakes College Agricultural and Energy Center in Staples, MN in August, 2012. This project helped lay the groundwork for a number of expanded educational opportunities for many fruit and vegetable growers throughout the state.

PROJECT APPROACH

5. Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

During the grant period we conducted a total of 15 workshops and three field days. Grant dollars also provided scholarships for additional individual instruction for beginning growers. Over the course of the grant, 17 individual growers received scholarships. These growers were beginners or had recently had crop failures that would have prevented them from enrolling in the specialty crop management program. The growers all received five farm visits. Another six growers attended the workshops and received follow up visits, where specific problems related to their farms were discussed.

Promotion of the workshops and field days went to specialty crop producers. Program content of the workshops and field days specifically addressed specialty crop issues. Those who attended were specialty crop producers. Everything related to this project focused on the production and marketing of specialty crops.

Number of beneficiaries:

Workshop registrations:	256
Field day participants:	149
Scholarships	<u>17</u>
Total:	422

The Minnesota Fruit & Vegetable Growers Association and the Central Lakes Specialty Crops Management Program were the primary stakeholder groups.

The primary beneficiaries were the specialty crop producers who attended the workshops and field days and producers who received scholarships to the specialty crops management program. Many of the producers were smaller operations and relatively new to specialty crop production. Those who received the scholarships were beginning growers or producers who recently had crop failures and the scholarships allowed them to receive farm visits from the specialty crops management instructor who worked with them on issues specific to their farm.

6. Present the significant contributions and role of project partners in the project.

Project partners were the Minnesota Fruit & Vegetable Growers Association (MFVGA) and Central Lakes College. Dell Christianson, retired specialty crops management instructor, was also very involved in workshop planning. Mr. Christianson also planned the agenda for and conducted six soil management workshops held during the first and second years of the project. Thaddeus McCamant planned the agenda for and

conducted nine of the specialty crop management workshops over the three years, worked with growers through on-farm instruction and worked with experienced growers to plan the three field days. Marilyn Johnson with MFVGA provided oversight for the project, compiled information for reports, worked with workshop presenters on planning, promotion, and coordination of the workshops and field days.

GOALS AND OUTCOMES ACHIEVED

- 7. Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.**

Activities included 15 workshops, three field days and several scholarships for beginning growers.

Year 1 – Three “Managing Your Soils: Soil Test Interpretation, Analysis, Application and Nutrient Management” workshops and three “Market and Business Feasibility: Managing the Uncertainty of Specialty Crops” and a field day at Straight River Farm were held. In addition, thirteen beginning growers received scholarships for the Central Lakes College Specialty Crops Management Program.

Year 2 – Three “Managing Your Soils: Crop Nutrient Needs, Soil Health and Nutrient Availability,” three “Market and Business Feasibility: Managing Specialty Crops for Profit,” and a field day at Bauer Berry Farm were held. In addition, twenty-one scholarships were awarded for the Central Lakes College Specialty Crops Management Program.

Year 3 – Three “Specialty Crop Management: Controlling Pests in Specialty Crops” and a field day at Pleasant Valley Orchard were held. In addition, seven scholarships were awarded for the Central Lakes College Specialty Crops Management Program.

- 8. If outcome measures were long term, summarize the progress that has been made towards achievement.**

Our outcome measures were not long term, but the benefit for the growers will have long term impact as they continue to develop and practice skills learned through this project.

- 9. Provide a comparison of actual accomplishments with the goals established for the reporting period.**

Goal 1: Provide in-depth training on soil analysis, interpretation and fertility plan development.

Accomplishment: Six soils management workshops were held. Three workshops titled “Managing Your Soils: Soil Test Interpretation, Analysis, Application and Nutrient Management” were held in the spring of 2013 and three workshops titled “Managing Your Soils: Crop Nutrient Needs, Soil Health and Nutrient Availability” were held in the spring of 2014. Workshops were held in Brainerd, MN; Anoka, MN; and Mankato, MN.

Benchmark: 30-50 people attending

Accomplishment:

45 people attended the 2013 workshops.

35 people attended the 2014 workshops.

45 people attended the 2013 field day.

The 2013 field day was held on September 23, 2013 and gave growers the opportunity to look at different soil types and crops in the field. A corresponding soil analysis and tissue analysis was available for each soil type. The soil management discussion was led by Dell Christianson and covered soil tests and soil types, soil health, plant nutrient needs and soil nutrient availability throughout the year and managing soil nutrient availability. Growers were encouraged to bring copies of their soil tests for individual consultation. Other individual follow-up with workshop participants was done as time allowed. Other topics addressed during the 2013 field day were management of the spotted wing drosophila, russetting in apples and black root rot in strawberries.

Target: 75% of participants indicate an increased understanding of soil analysis, interpretation and fertility plan development.

Accomplishment:

Evaluations given at the end of each workshop show that all of the attendees increased their understanding of the topics presented.

Goal 2: Provide in-depth training on specialty crop market assessment and business feasibility

Accomplishments: Three workshops titled "Market and Business Feasibility: Managing the Uncertainty of Specialty Crops" were held February of 2013. Three workshops titled "Market and Business Feasibility: Managing Specialty Crops for Profit" were held in February of 2014. Three workshops titled "Specialty Crop Management: Controlling Pests in Specialty Crops" were held in February of 2015.

Benchmark: 30-50 people attending

Accomplishment:

58 people attended the 2013 workshops.

48 people attended the 2014 workshops.

70 people attended the 2015 workshops.

50 people attended the 2014 field day.

54 people attended the 2015 field day.

The 2014 field day was held September 29, 2014. Topics for the field day included hiring and managing labor, blueberry production (applying mulch, weed suppression, removing trees, electric pruners), strawberry production equipment, challenges in older fields, issues resulting from heavy snow, spring rowcovers, getting teenage labor to hand weed and quality sweet corn production.

The 2015 field day was held September 21, 2015 under the topic of "Profitable Apple and Strawberry Production." Included in the discussion were direct costs, overhead costs, initial and additional investment, volume produced, quantity available for sale and quality of product. Managing employees and the overall quality of the customer experience were also discussed. Secondary crops for diversification and customer appeal were highlighted.

Target: 75% of participants indicate an increased understanding of how to assess market feasibility.

Accomplishment:

Evaluations given at the end of each workshop show that all of the attendees increased their understanding of the topics presented.

10. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.

BENEFICIARIES

11. Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

The Minnesota Fruit and Vegetable Growers Association strengthened its position and relationship with members by being able to offer these programs to members and other area fruit and vegetable growers. Helping beginning growers increase their chances of success helps the association grow by potentially increasing membership. Central Lakes College benefitted by the opportunity to introduce new growers to the value of on-farm individualized instruction based on the grower's background and strengths.

The greatest benefit goes to the growers who have attended the workshops and field days and to those who have received scholarships to offset the cost of the specialty crops management program at Central Lakes College.

Follow-up surveys were mailed to growers who attended workshops during the three years. 46 surveys were sent to farms represented at the managing soils workshops. 16 of those surveys were returned. All of the respondents were performing soil tests with 93% regularly using soil tests to balance the timing of nutrient and micronutrient applications. Half of the respondents were using soil tests in conjunction with tissue analysis or other nutrient monitoring techniques. All of the respondents indicated they were more comfortable reading and interpreting soil tests and had a better understanding of the importance of soil testing, nutrient availability,

and biological activity relating to soil health. Two-thirds of the respondents have noticed an increase in yields and three fourths of them noticed an increase in the quality of their produce.

Follow-up surveys were also sent to farms represented at the managing specialty crops workshops. 69 surveys were sent, 23 surveys were returned. Because a wide range of topics were covered during these workshops and field days and growers represented different levels of experience, it is harder to quantify responses. Overall, growers indicated they were able to evaluate the cost/benefit of crop insurance, were able to identify which crop was their most profitable, and saw an increase in sales and customer interaction through social media such as Facebook. They indicated they were more comfortable with their abilities to identify insect pests and plant diseases and they reported their pest control measures were at least somewhat effective.

They were asked to share the most useful information obtained from the workshops. Responses varied and included tips for making financial decisions regarding new equipment, time management and timing of specific activities for maximum effectiveness, insect identification and management. One of the most appreciated aspects of the workshops and field days is the ability for growers to talk with each other and find out what has or has not worked for other growers. This is especially important when new growers can talk with more experienced growers.

Secondary benefits accrue to the consumers who have the opportunity to purchase higher quality local produce.

12. Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

Although the follow up surveys indicated that people are able to identify profitable crops and the measures taken in the last three years do indicate an increase in yield and quality for a number of producers, we have not specifically asked how much of an economic impact this project has had on their operations. We believe there has been an economic impact, but it will vary by producer and will be affected by a number of factors including customer demand, weather conditions, pest pressure and other circumstances outside the control of the producer.

LESSONS LEARNED

13. 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.

Soil management and fertility and soil biological activity has become a top priority for many producers. They recognize that healthy soil, able to supply the nutrients that plants need when plants need them, produces greater yields and a higher quality product. We had anticipated the series of soils workshops to draw more producers. On the other hand, more information on soil health was also available at various conferences, etc. during that timeframe and growers may have felt the subject was adequately covered or didn't recognize the need for more in-depth information.

This project reconfirmed that growers learn a lot from each other and there is great value when a group of growers can network and interact with each other.

14. Provide unexpected outcomes or results that were an effect of implementing this project.

When the Specialty Crops program was moved to the Ag and Energy Center in Staples, a secondary project was started called "Orcharding in the North." Part of the Orcharding in the North project involved giving seminars on tree fruit production in Zone 3 areas of Minnesota geared towards home gardeners. There were four sessions held at the Ag and Energy Center in Staples for home gardeners, and each session averaged 45 attendees.

15. If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

Goals were met.

ADDITIONAL INFORMATION

16. Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.

Project 2

MN Specialty Crop Block Grant FINAL PERFORMANCE REPORT

Submitted by: Mark Abrahamson

e-mail & phone number: mark.abrahamson@state.mn.us, 651-201-6505

Date: 11/30/2015

PROJECT TITLE

1. Provide the project's title.

Assessing the role of soybean aphid as a vector of PVY in Minnesota seed potatoes

PROJECT SUMMARY

2. Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

This project was initiated to evaluate the role of the soybean aphid, *Aphis glycines*, as a vector for Potato Virus Y (PVY). Although it was known that soybean aphid is able to vector this virus, it was not known how frequently soybean aphid moved into potato fields and probed plants enough to transmit the virus. However, it was considered possible that soybean aphid had become an important PVY vector because of increasing issues with PVY despite apparent low numbers of the usual PVY vectors.

3. Establish the motivation for this project by presenting the importance and timeliness of the project.

The rejection rate for seed potato lots in Minnesota due to PVY infection increased in the recent past (35% in 2009 to 54% in 2011) and disease vectoring by soybean aphid is considered to be one of the possible reasons. PVY can result in the loss of seed potato certification which reduced the value of the seed by about \$10/cwt or about \$3,500 per acre. In Minnesota there were about 8,700 acres of seed potatoes when this project began which means a worst case impact of up to \$30.45 million.

4. If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

This was the first project funded by the SCBGP regarding soybean aphids and PVY in Minnesota.

PROJECT APPROACH

5. Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

2013

The MN Department of Agriculture's Plant Protection Division contracted with the University of MN, Dr. Ian MacRae (Dept of Entomology) to coordinate, establish and monitor a suction trap network for soybean aphids. In the summer of 2013, soybean aphids were collected via suction traps from 16 sites in Minnesota and North Dakota to determine seasonal abundance and geographic abundance patterns. A total of 162 soybean aphids were collected which comprised 6.3% of total aphid capture. Soybean aphids were captured from early July through late September, peaking in the last weeks of August. No geographic pattern was detected to explain variance in aphid abundance among trap locations. Pan traps were also placed in potato fields in increasing increments from field edge to center. No difference in capture rates was observed from field edge to center. A total of 43 aphids recovered from suction traps and 22 aphids recovered from pan traps were tested with PCR to determine if they carried PVY - all tested negative.

During the 2013 survey season of June 21 through Sept 26 weekly field results were posted to the web (<http://aphidalert.blogspot.com>) and emailed to cooperators once or twice a week. The same material was sent out via the Northern Plains Potato Growers Association (NPPGA) weekly email and was linked from the North Dakota State University potato Extension page (<http://www.ag.ndsu.edu/potatoextension>). Information was also announced via Twitter (@MNSpudBug).

The 2013 results were presented at the Entomological Society of America North Central Branch Annual Meeting in Des Moines, Iowa:

MacRae, I.V. and N. Russart. 2014. Aphid Alert II - Monitoring flights of vectors of Potato Virus Y. North Central Branch Entomology Society of America Annual Meeting, Des Moines, IA. Mar 9-12, 2014.

The total attendance at the meeting was 365.

2014

In the summer of 2014, soybean aphids were collected via suction traps established at 20 locations in MN and North Dakota with 19 reliably reporting weekly (one trap's cooperator did not submit weekly samples). A total of 531 soybean aphids were collected, comprising 14.69% of all aphids recovered in the traps (21.2% of all vector species). Soybean aphids were not collected prior to the first week in August with the peak capture occurring the week of August 25. No geographic pattern was detected to explain variance in aphid abundance among trap locations. Pan traps were placed in potato fields in increasing increments from field edge to center. Only 7 aphids were recovered from these traps, insufficient to discern within field distribution. A total of 49 captured aphids were tested for the presence of PVY – all were negative. In 2013, none of the soybean aphids recovered in pan traps or samples tested from suction traps tested positive for the presence of PVY.

During the survey season weekly field results were posted to two websites (<http://aphidalert.blogspot.com> AND <http://aphidalert.umn.edu>) and emailed to cooperators once or twice a week. The same material was sent out via the Northern Plains Potato Growers Association (NPPGA) weekly email and was linked from the North Dakota State University potato Extension page (<http://www.ag.ndsu.edu/potatoextension>). Information was also announced via Twitter (@MNSpudBug).

2014 results were presented at the Entomological Society of America National Meeting in Portland OR: Russart, N. and I. MacRae. 2014. Monitoring flights of vectors of Potato Virus Y in Minnesota and North Dakota. Entomological Society of America Annual Meeting. Portland, OR, Nov 16-19, 2014.

According to the Entomological Society of America website, accessed 12/30/2015, "more than 3,400 attendees participated in Entomology 2014 in Portland, Oregon."

During the 2014/2015 winter, two trap sites were established at the grow-out site in Hawaii. One proximal to the MN planting site and one approximately 0.5 miles away. Traps were monitored for seven weeks and samples returned to the UMN-NWROC entomology lab in Crookston. A total of only 13 vector species were recovered, none of which were highly efficient at transmitting PVY. The trap associated with the MN site captured fewer aphids (only four total aphids over two weeks). The very low catch

numbers and the relative efficiency indicates that within the 2014/2015 winter grow-out season the transmission of PVY was very unlikely.

6. Present the significant contributions and role of project partners in the project.

The University of Minnesota, under the leadership of Dr. MacRae coordinated, established and monitored the aphid suction trap network. This included servicing and maintaining the traps, as well as sorting and identifying the trap captures from sites in Minnesota, North Dakota and Hawaii during the winter grow-outs. The University of Minnesota also coordinated all within-season and post-season communications with growers and other stakeholders including scientific presentations and publications.

The University of Minnesota subcontracted with Dr. Gudmestad at North Dakota State University to test soybean aphids for the presence of Potato Virus Y. A microbiologist in Dr. Gudmestad's lab used Polymerase Chain Reaction (PCR) to extract RNA from supplied aphid samples and tested them for the presence of Potato Virus Y RNA.

The Minnesota Department of Agriculture provided administrative oversight of the project including preparing and monitoring contractual agreements with the University of Minnesota; and the preparation and submission of reports throughout the project.

GOALS AND OUTCOMES ACHIEVED

7. Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.

The first goal stated for the project was to assess the role of soybean aphid in introducing PVY inoculum into seed potato fields and its role in spreading PVY from plant to plant within fields. The measure used as to whether this goal was accomplished was replicated scientific studies. The following studies were carried out during this project:

- 2013:
 - Suction-trap network reestablished for monitoring aphids. Soybean aphid as well as 14 other species were collected, identified and results reported online weekly during the growing season.
 - Soybean aphids collected by traps were analyzed for presence of PVY
 - Pan traps were placed in potato fields to monitor for soybean aphid movement into fields
- 2014:
 - Soybean aphid as well as 14 other species were collected, identified and results reported online weekly during the growing season.
 - Soybean aphids collected by traps were analyzed for presence of PVY
 - Pan traps were placed in potato fields to monitor for soybean aphid movement into fields
- 2015:
 - Traps were used to monitor for aphid vectors of PVY during the winter potato grow-out in Hawaii.

The second goal stated for the project was to produce high-quality scientific data and this was to be measured by the data being presented at national and/or regional meetings as well as publication in a peer-reviewed scientific journal. This goal was met by three presentations at regional and national meetings with data generated by the project. In addition, a journal article regarding the study is in process.

The suction trap network managed by the U of M determined that soybean aphid composed a small portion of the total aphid vector population in 2013. However, historical data indicated that this percentage can be significantly greater in years with heavier soybean aphid pressure. Also, Dr. MacRae's group detected no difference in aphid numbers at field edges compared to field centers.

8. If outcome measures were long term, summarize the progress that has been made towards achievement.
9. Provide a comparison of actual accomplishments with the goals established for the reporting period.

The goals of the project were to assess the role of soybean aphid in introducing PVY inoculum into seed potato fields and its role in spreading PVY from plant to plant within fields as well as to produce high-quality scientific data. The measures of these goals were the production of replicated scientific studies and meeting presentations.

Both of these goals were accomplished. Although studies were hampered by low levels of soybean aphid, replicated observations were made that did not indicate soybean aphid plays a significant role in the introduction of PVY inoculum into fields. While these results do not establish soybean aphid as a major source of field infection, they do not exclude a role in within-field movement.

There were not sufficient numbers of soybean aphid captured in 2013 or 2014 to determine colonization patterns within fields. However, anecdotal and observational data from this region seems to indicate that, at least in larger fields, there may be some edge effect but it is temporally ephemeral.

The work from this project was presented at two meetings during the course of the project including one regional and one national conference:

MacRae, I.V. and N. Russart. 2014. Aphid Alert II - Monitoring flights of vectors of Potato Virus Y. North Central Branch Entomology Society of America Annual Meeting, Des Moines, IA. Mar 9-12, 2014. Attendance figures for this meeting have been requested from the Entomological Society of America but are not yet available.

Russart, N. and I. MacRae. 2014. Monitoring flights of vectors of Potato Virus Y in Minnesota and North Dakota. Entomological Society of America Annual Meeting. Portland, OR, Nov 16-19, 2014. According to the Entomological Society of America website, accessed 12/30/2015, "more than 3,400 attendees participated in Entomology 2014 in Portland, Oregon."

10. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.

Data on abundance of soybean aphid relative to other potential vectors in potato growing areas was collected as a result of the project. Further work may be needed to continue evaluating the role of soybean aphid in vectoring PVY during a year of higher soybean aphid abundance, but the work done on this project could be used for comparison to a time of lower soybean aphid pressure.

BENEFICIARIES

11. Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

Potato growers in Minnesota and North Dakota have and will continue to benefit from this project. According to the USDA, National Agricultural Statistics Service, potatoes were harvested on 48,212 acres among 559 farms in Minnesota and 85,844 acres among 189 farms in North Dakota during 2012. In Minnesota, the value of the potato crop in 2014 was estimated at \$151.7 million (Minnesota Ag News – Potatoes, September 17, 2015, USDA Ag Statistics). Numerous studies have documented yield reductions from PVY as high as 40 – 80% (De Bokx and Huttinga, 1981, Hane and Hamm, 1999, Rykbost et al, 1999).

Thus, the economic impact of PVY in Minnesota could be as high as \$60 – 120 million in any given year. By providing better monitoring tools for aphid vectors of PVY these potential losses have likely been reduced although to what degree is difficult to estimate.

This project provided the impetus for the reestablishment of a suction-trap network in Minnesota and North Dakota for aphids vectoring PVY. Moreover, the network now includes a new PVY Vector Risk Index to help growers quickly discern risk posed by captures of various aphid species. Despite funding from this project for the University of Minnesota ending March 31, 2015 the Aphid Alert network and website continued to function in 2015: <http://aphidalert.blogspot.com/>

Additionally, plans are being made to continue monitoring for PVY vectors during the 2015/2016 winter grow-out in cooperation with other states.

12. Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

The Aphid Alert network provides weekly counts of aphid vectors of PVY. Additionally, the University of Minnesota has calculated a PVY risk factor that accounts for the relative efficiency of different species at vectoring PVY. The weekly trap captures result in a measure of aphid abundance and a measure of PVY risk by incorporating the relative efficiency of each species into an overall PVY risk rating.

LESSONS LEARNED

13. 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.

The project was very successful in helping to re-establish a valuable monitoring tool for seed potato producers in Minnesota. The Aphid Alert Network has expanded and now incorporates new tools (e.g. the PVY Vector Risk Index) to provide producers with real-time assessments of the vector pressure in the various seed potato producing areas of the state. While there were insufficient data to completely assess the role of soybean aphid as a PVY vector, the correlation of Soybean Aphid population dynamics in years with high PVY rejection but low aphid vector populations seems to suggest that this insect may be playing the same role as other vector species (i.e. spreading existing inoculum within fields).

14. Provide unexpected outcomes or results that were an effect of implementing this project.

The PVY Vector Risk Index was not proposed as part of the initial study but developed as a result of this work. Additionally, the continuation of the Aphid Alert monitoring network as well as continued PVY vector monitoring during winter grow-outs are benefits of the project that were not part of the initial proposal.

15. If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

A more thorough evaluation of the role of soybean aphid in vectoring PVY may have been possible if soybean aphid populations were higher during the years of the study. For future studies, broadening the study area or incorporating more collection points may enable higher numbers of aphids to be analyzed.

ADDITIONAL INFORMATION

16. Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.

References cited:

de Bokx, J. A. and H. Huttinga. 1981. Potato Virus Y. Descriptions of Plant Viruses, No. 242. Commonwealth Mycological Institute/ Association of Applied Biologists, Kew, England.

Hane, D.C., and P.B. Hamm. 1999. Effects of seed borne potato virus Y infection in two potato cultivars expressing mild disease symptoms. *Plant Disease* 83: 43–45.

Rykbost, K.A., D.C. Hane, P.B. Hamm, R. Voss, and D. Kirby. 1999. Effects of seed-borne potato virus Y on Russet Norkotah performance. *American Journal of Potato Research* 76: 91–96.

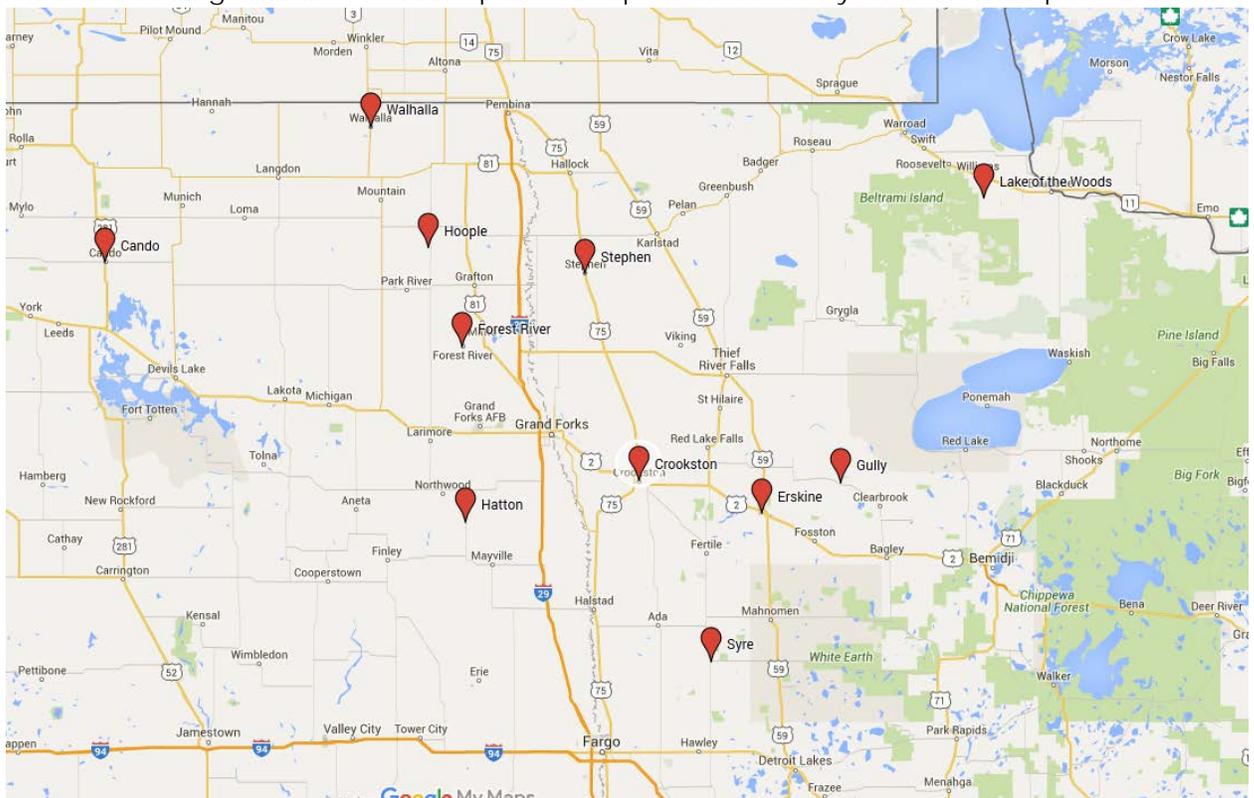
See the following material for information placed on Aphid Alert blog during 2013 and 2014, as well as a graphical summary of results from 2014/2015 winter grow-out.

2013 Aphid Suction Trap Results:

Aphid Alert II – Monitoring Aphid Vectors of Virus in Potato

The Network

Sixteen suction traps were emplaced next to potato fields in Minnesota and North Dakota during the 2013 growing season (Fig 1). Traps consisted of a 1.5 meter vertical PVC pipe housing a fan powered by a solar panel. The fan sucks passing insects into the trap and deposits them into a collection jar filled with a water / ethylene glycol mixture (antifreeze). Cooperators replaced collection jars weekly and mailed them to the lab for identification and counting. Number of each species of aphid collected by location were posted to the web



(<http://aphidalert.blogspot.com/>) and emailed to cooperators once or twice a week.

Results

A total of 2543 aphids representing 14 vector species were collected from June 21 through September 26. Of these, 1854 were vectors of PVY. Number of vector aphids varied widely by location with the Linton II site collecting 288 vectors and the Syre site collecting only 3 vectors. Four sites observed high aphid numbers, totaling more than 200 vectors at each site (Linton II, Hatton, Walhalla, and Staples). Eight sites had moderate aphid levels collecting between 50 and 150 vectors (Gully, Hoople, Forest River, Linton I, Crookston, Lake of the Woods, Perham, and Sabin). Finally, four sites had low vector counts, collecting less than 50 throughout the season (Syre, Stephen, Cando, and Erskine). No trend was observed that would indicate geographic location affected the number of aphids collected; some of the sites nearest to each other had dramatically different vector counts. While this may have been simply a reflection of wind events, which experience significant local variation, local alternate hosts may have had some influence on local aphid populations. Analyses examining the possible influence of neighboring cropping systems will be examined.

Aphid flight increased gradually throughout the beginning of the season then dramatically in August, peaking the week of August 23rd. This supports the idea that most of our aphid flight, and therefore most of our vectored

inoculum movement, occurs later in the season. The total number of green peach aphid, the most efficient vector of PVY, remained low throughout the season. While not as efficient a vector, soybean aphid have the capacity to develop very high populations in which case the sheer number of aphids increases the amount of virus transmitted. However, in 2013 we did not see large outbreaks in soybean aphid populations.

Aphid Alert Blog Posts from 2013

June 28, 2013

All trap locations are now in, additional locations may be added in the next 2 weeks. Numbers of aphids trapped in catches for the first 3 weeks of the network have been low. There were no aphids recovered in the first week (ending Jun 14). However, high populations of English grain aphid have been reported in small grains in southern and west central MN and in SE and east central ND. IN addition, soybean aphids have been reported colonizing volunteer soybeans in southern MN. These populations may indicate 2013 will become an aphid year. Vigilant scouting for and management of aphids is advised.

	Aphid Species Captured (aphid/trap)																
	Cando ND	Walhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookston MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN	
Green peach aphid (<i>Myzus persicae</i>)																	
Soybean aphid (<i>Aphis glycines</i>)																	
Bird cherry oat aphid (<i>Rhopalosiphum padi</i>)																1	
Corn leaf aphid (<i>Rhopalosiphum maidis</i>)																	
English grain aphid (<i>Sitobion avenae</i>)							1										
Green bug (<i>Schizaphis graminum</i>)																	
Potato aphid (<i>Macrosiphum euphorbiae</i>)							1										
Sunflower aphid (<i>Aphis helianthi</i>)																	
Thistle aphid (<i>Lipaphis erysimi</i>)																	
Turnip aphid (<i>Brevicoryne brassicae</i>)																1	
Cotton/melon aphid (<i>Aphis gossypii</i>)																	
Pea aphid (<i>Acyrtosiphon pisum</i>)																	
Cowpea aphid (<i>Aphis craccivora</i>)																	
Black bean aphid (<i>Aphis fabae</i>)								1									
Buckthorn aphid (<i>Aphis nasturtii</i>)																	
Identified non-vectored species														1			
Not ID'd																	
Total # captured	0	0	0	0	0	0	2	1	0	0	0	0	0	1	0	0	2
Total Vectors	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	2

July 7, 2013

**** Soybean aphids found in Crookston, July 05!! ****

All trap locations are now in, additional locations may be added in the next 2 weeks. Numbers of aphids trapped in catches for the first 3 weeks of the network have been low. There were no aphids recovered in the first week (ending Jun 14). However, high populations of English grain aphid have been reported in small grains in southern and west central MN and in SE and east central ND. In addition, on Friday, July 05, a colony of soybean aphids were found in Crookston. This colony is no more than 4 days old. These populations may indicate 2013 will become an aphid year. Vigilant scouting for and management of aphids is advised.

	Aphid Species Captured															
	Cando ND	Wallhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Green peach aphid							1									
Soybean aphid																
Bird cherry oat aphid						2										
Corn leaf aphid						1										
English grain aphid						1										
Green bug																
Potato aphid						1										
Sunflower aphid									1							
Thistle aphid																
Turnip aphid																
Cotton/melon aphid																
Pea aphid																
Cowpea aphid							1						2			
Black bean aphid					2			1								2
Buckthorn aphid																
Identified non-vectored species			3		9	2	6	1				1				
Not ID'd																
Total # captured	0	0	3		11	7	8	2	1	0	0	1	2	0	0	2
Total Vector	0	0	0	0	2	5	2	1	1	0	0	0	2	0	0	2

July 14, 2013

Aphid catches in many locations are increasing. If not already doing so, producers should be applying crop oils and scouting for aphids. Remember, for crop oils to be most effective, they must be applied prior to the arrival of colonizing aphids. If there are aphids already in the area, application of oils can still limit the spread of PVY. Data indicates applying crop oils twice weekly applications may be more efficacious than once weekly; rapidly growing plants will obviously benefit from more the more frequent application schedule. It's important to use sufficient water to ensure complete coverage.

If aphids are found in fields, treatment with an anti-feedant insecticide such a Fulfill or Beleaf may be indicated. Both products recommend: waiting 7 days applications if a second is necessary, to use sufficient water to ensure complete coverage and ensuring new plant foliage is covered. Because both insecticides work by stopping feeding, aphids may not die immediately, but feeding (and probing) will stop and with it, the transmission of PVY.

Aphid numbers in small grains are established in multiple locations and can be expected to move into potatoes as wheat matures. Soybean aphid numbers are increasing in many areas in MN and ND. This looks to be developing into an aphid vector year. Scout vigilantly, manage aggressively.

	Aphid Species Captured Jun 28 - Jul 05															
	Cando ND	Wallhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Green peach aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soybean aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bird cherry oat aphid	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1
Corn leaf aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
English grain aphid	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Green bug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potato aphid	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Sunflower aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thistle aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turnip aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cotton/melon aphid	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	1
Pea aphid	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cowpea aphid	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	3
Black bean aphid	0	2	0	2	1	1	0	0	0	0	0	0	0	0	0	0
Buckthorn aphid	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Identified non-vectored species	1	1	2	30	3	2	3	0	2	19	0	3	0	3	0	2
Not ID'd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total # captured	2	5	2	40	5	5	4	0	2	21	1	4	0	3	1	8
Total Vectors	1	4	0	10	2	3	1	0	0	2	1	1	0	0	1	6

July 21, 2013

Aphid catches in many locations took a very large jump this week. At least one site reported Green Peach Aphids and 3 locations reported Soybean aphids. This is developing into a potentially high aphid year; the appearance of the two most important vectors of PVY is concerning. While the **seasonal** timing for the movement of aphid vectors into potato fields is well within the expected time frame, many fields throughout the region were planted late, and so the plants are younger than they ordinarily would be at this time. The younger the plant is when it contracts the virus, the greater the concentration of virus will develop in the plant by the end of the season. This means later flights of aphids (esp. late season soybean aphids) entering seed

potato fields will have more inoculum to move around the current aphids are not prevented from entering fields and probing plants now. Aggressive and vigilant scouting is recommended, the application of crop oils, if not already begun, should start now. If aphids are already in fields, the use of the anti-feedant insecticides, Fulfill or Beleaf can be applied to prevent some transmission and within-field movement of PVY.

	Aphid Species Captured Jul 05-Jul 12															
	Cando ND	Wallhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Green peach aphid	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Soybean aphid	0	0	0	0	0	0	0	1	0	0	1	3	0	0	0	0
Bird cherry oat aphid	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0
Corn leaf aphid	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0
English grain aphid	0	0	0	0	0	0	5	3	0	0	2	0	0	0	0	0
Green bug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potato aphid	0	0	0	0	0	2	0	5	0	0	1	0	0	0	0	0
Sunflower aphid	0	0	0	0	0	0	0	3	0	1	0	2	0	0	0	0
Thistle aphid	1	0	0	0	0	1	0	4	0	0	1	0	0	0	0	0
Turnip aphid	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Cotton/melon aphid	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Pea aphid	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Cowpea aphid	0	0	0	0	0	1	5	5	0	0	3	0	0	0	0	0
Black bean aphid	0	0	0	0	0	6	3	5	0	0	2	1	0	0	2	0
Buckthorn aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Identified non-vectored species	0	0	0	0	0	0	7	33	0	0	4	0	0	0	3	0
Not ID'd	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total # captured	1	0	0	0	0	10	22	69	0	1	15	6	1	0	8	0
Total Vectors	1	0	0	0	0	10	15	35	0	1	11	6	1	0	5	0

July 28, 2013

Green peach aphids (GPA) have been recovered in several traps this week; traps in Forest River (ND) and Crookston, Perham and Staples (MN) all recovered GPA. Green peach aphid is perhaps the most efficient vector of PVY. Its appearance is further indication aggressive scouting and management are a good idea this season. Soybean aphid (SBA) also continues to make its presence known this week; the traps at Walhalla and Linton II (ND) and Gully and Crookston (MN) all recovered SBA this past week. While not as effective a vector of PVY as is green peach aphid, soybean aphids are probably the second most important vector in the disease epidemic because their dispersal events involve very high numbers of the aphid. We can expect increased

movement of soybean aphids over the next 2 weeks, reports from Bruce Potter at the SW Research & Outreach Center indicate soybean aphids there are developing wings and this indicates an impending dispersal event. Southerly winds will bring increasing numbers of soybean aphids into the Red River Valley from southern locations.

Trap catches are variable this week at different locations with some trap locations recovering increased numbers and others recovering lower numbers of aphids. Vector species persist, and non-vector species continue to be recovered, indicating aphid movement is occurring. For the species captured at each location, see the weekly and cumulative tables below. For a quick glance at the seasonal pattern of vector capture, see the bar graphs near the bottom of the page.

	Aphid Species Captured - July12 - July21															
	Cando ND	Wallhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Green peach aphid		0	0	1	0	0	0	0	0	0	1	0		0	1	1
Soybean aphid		1	0	0	0	0	1	0	0	1	4	0		0	0	0
Bird cherry oat aphid		0	0	0	0	0	3	0	0	0	0	0		0	0	0
Corn leaf aphid		0	0	0	0	1	0	1	0	0	0	0		0	0	0
English grain aphid		0	0	0	2	3	3	0	0	0	3	0		0	1	0
Green bug		0	0	0	0	0	0	0	0	0	0	0		0	0	0
Potato aphid		0	0	0	0	0	0	1	0	0	0	1		0	1	1
Sunflower aphid		0	0	1	2	0	1	0	0	0	0	0		0	0	1
Thistle aphid		1	0	1	0	0	5	0	0	4	1	0		0	0	0
Turnip aphid		0	0	0	0	0	0	0	0	0	0	0		0	0	0
Cotton/melon aphid		0	0	0	0	1	0	1	0	0	1	0		0	0	0
Pea aphid		1	0	0	0	0	3	0	0	2	0	0		0	0	0
Cowpea aphid		0	3	0	1	0	0	0	0	0	0	0		0	0	0
Black bean aphid		1	1	0	4	0	1	0	0	0	1	0		0	2	1
Buckthorn aphid		0	0	0	0	0	0	0	0	0	0	0		0	0	0
Identified non-vectored species		2	1	1	0	0	2	1	1	0	3	0		0	1	3
Not ID'd		0	0	0	0	0	0	0	0	1	0	0		0	0	0
Total # captured	0	6	5	4	9	5	19	4	1	8	14	1	0	0	6	7
Total Vectors	0	4	4	3	9	5	17	3	0	7	11	1	0	0	5	4

August 4, 2013

The number of aphid vectors recovered at many sites decreased this week, however, with the Sturgis Rally right around the corner, we might expect the *Sturgis Dispersal Event* (coined by Bruce Potter at the SWROC in Lamberton) to bring us soybean aphids in the next 2 weeks. While the name may seem light-hearted, it does accurately describe roughly the timing of a late season movement of soybean aphids (generally late July / early August) that often bring aphids into northern Minnesota, North Dakota, and Manitoba. Soybean aphids

have been recovered from several locations (especially Crookston, MN) for the past 3 sampling weeks.

Aphid populations are well-established in the region by now, small grains began have been senescing and the traps at many locations have been recovering cereal aphids for several weeks now. There are vectors in the region and aggressive management is recommended!

Aphid Species Captured - captures from July 21 - July 30																
	Cando ND	Wallhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Sample rec'd	29-Jul	30-Jul	26-Jul					30-Jul			29-Jul	30-Jul			26-Jul	
Green peach aphid	0	0	0					0			0	0			0	
Soybean aphid	0	0	0					1			5	0			0	
Bird cherry oat aphid	0	1	2					0			0	0			1	
Corn leaf aphid	0		0					1			0	0			0	
English grain aphid	0	0	1					0			3	5			3	
Green bug	0	0	0					0			0	0			0	
Potato aphid	0	0	0					0			0	0			1	
Sunflower aphid	0	0	0					0			0	0			0	
Thistle aphid	0	0	0					0			0	0			0	
Turnip aphid	0	0	0					0			0	0			1	
Cotton/melon aphid	0	0	1					0			0	0			0	
Pea aphid	0	0	0					0			0	0			0	
Cowpea aphid	0	0	0					0			0	1			0	
Black bean aphid	0	0	0					0			0	3			0	
Buckthorn aphid	0	0	0					0			0	0			0	
Identified non-vectored species	0	0	1					5			5	4			0	
Not ID'd	0	0	0					0			0	0			0	
Total # captured	0	1	5	0	0	0	0	7	0	0	13	13	0	0	6	0
Total Vectors	0	1	4	0	0	0	0	2	0	0	8	9	0	0	6	0

August 11, 2013

The cooler temperatures have slowed population development resulting in lower captures this week but a number of locations are still reporting significant aphid captures. Thankfully, this week we have not yet recovered any green peach aphids or soybean aphids (we still have 4 traps yet to identify from that period). This remains an aphid year and flights are still expecting to continue. If you have not yet vine killed, then...

Aphid Species Captured - captures from July 30 - Aug 05																
	Cando ND	Wallhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Sample rec'd	31-Jul			5-Aug	5-Aug	31-Jul	31-Jul		30-Jul	31-Jul	5-Aug		5-Aug	1-Aug	5-Aug	1-Aug
Green peach aphid	0			0	0	0	0		0	0	0		0	0	0	0
Soybean aphid	0			0	0	0	0		0	0	0		0	0	0	0
Bird cherry oat aphid	0			0	0	0	4		0	0	0		0	2	0	0
Corn leaf aphid	0			0	0	0	1		0	0	0		0	0	0	1
English grain aphid	0			0	3	4	34		0	2	0		0	5	10	1
Green bug	0			0	0	0	0		0	0	0		0	0	0	0
Potato aphid	0			0	0	0	0		0	7	0		0	0	0	0
Sunflower aphid	0			0	0	1	0		0	0	0		0	0	0	2
Thistle aphid	0			0	0	0	0		0	0	0		0	0	0	0
Turnip aphid	0			0	0	0	0		0	0	0		0	0	0	0
Cotton/melon aphid	0			0	0	0	0		0	0	0		0	0	1	0
Pea aphid	0			0	0	1	0		0	0	0		0	0	0	0
Cowpea aphid	0			0	0	1	4		0	1	0		0	0	0	0
Black bean aphid	0			0	0	2	2		0	0	1		0	0	0	0
Buckthorn aphid	0			0	1	0	0		0	1	0		0	0	1	0
Identified non-vector species	0			0	1	0	29		1	1	2		0	1	1	0
Not ID'd	0			0	0	0	0		0	0	0		0	0	0	0
Total # captured	0	0	0	0	5	9	74	0	1	12	3	0	0	8	13	4
Total Vectors	0	0	0	0	4	9	45	0	0	11	1	0	0	7	12	4

August 18, 2013

Aphids continue to fly in the Red River Valley and beyond and vector captures increased in several locations this week. Catches in Hoople and Forest River (ND) and Stephen, Crookston, Erskine and Perham (MN) all recovered aphid vectors. Green peach aphids were recovered in the Hoople trap and soybean aphids were recovered in the Linton locations, Forest River, Stephen, Crookston, Lake of the Woods, Staples and Perham traps. Cereal aphids continued to be recovered in numbers from most locations. Additionally, there have

been reports of potato aphids in flax in Roseau, MN. We continue to have an aphid summer in MN and ND. So, vector pressure continues - if you have not yet vine killed, then...

Aphid Species Captured Aug09-Aug12																
	Cando ND	Wallhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Rec'd	14-Aug	13-Aug	13-Aug	12-Aug	14-Aug	14-Aug	14-Aug	14-Aug	13-Aug	14-Aug	12-Aug	12-Aug	14-Aug	14-Aug	12-Aug	14-Aug
Green peach aphid	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
Soybean aphid	0	0	0	1	6	0	0	0	1	0	1	0	0	0	1	1
Bird cherry oat aphid	1	0	8	0	6	3	12	0	0	0	1	3	0	1	0	15
Corn leaf aphid	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0
English grain aphid	0	5	9	5	2	3	31	3	0	0	5	5	0	7	3	7
Green bug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potato aphid	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1
Sunflower aphid	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	5
Thistle aphid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turnip aphid	0	0	0	0	0	1	1	0	0	3	0	0	0	0	0	2
Cotton/melon aphid	0	0	0	1	3	2	13	0	0	0	2	0	0	0	0	3
Pea aphid	0	0	1	0	0	4	5	1	5	0	1	0	0	3	0	2
Cowpea aphid	0	2	1	0	16	0	5	0	4	0	0	0	0	0	0	0
Black bean aphid	0	0	0	9	0	0	0	0	0	0	1	0	0	5	0	0
Buckthorn aphid	0	0	0	0	5	0	3	0	0	0	1	1	0	3	0	0
Identified non-vectored species	0	5	7	6	23	4	15	2	1	4	3	1	0	3	0	8
Not ID'd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total # captured	1	12	27	23	62	19	87	6	11	8	15	11	0	22	6	44
Total Vectors	1	7	20	17	39	15	72	4	10	4	12	10	0	19	6	36

August 25, 2013

While trap captures were still significant, the numbers captured at many locations were down this week (with 5 locations yet to be sorted and ID'd). The two sites that had increased captures (Gully and Perham) had big increases, in the case of Gully, most of these were bird cherry oat aphids. There were no green peach aphids recovered at this time but soybean aphids were recovered from traps in Hoople, Hatton, Forest River, and Linton, ND and Perham and Staples, MN. In most years, numbers of soybean aphids can be expected to

increase and their distribution to broaden later in the season so these numbers are not surprising.

Cereal aphid captures remain high with bird cherry at and English grain aphids being common in most locations. Likewise, non-vector species also were numerous in the traps this week, indicating aphid movement is still active for many species.

So, vector pressure continues - if you have not yet vine killed, then...

	Aphid Species Captured 8/12 - 8/22															
	Cando ND	Walhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Rec'd	19-Aug	20-Aug	21-Aug	19-Aug	22-Aug	21-Aug	21-Aug	20-Aug	21-Aug	21-Aug	19-Aug	22-Aug			19-Aug	19-Aug
Green peach aphid	0	0	0	2	0	0	0	0	0	0	0	0			0	0
Soybean aphid	0	0	1	3	3	1	3	0	0	0	0	0			4	5
Bird cherry oat aphid	0	3	3	4	0	1	7	1	0	23	0	0			0	9
Corn leaf aphid	0	1	0	0	1	0	4	1	0	0	0	0			0	0
English grain aphid	0	2	1	6	0	5	7	0	0	2	4	1			4	12
Green bug	0	0	0	0	0	0	0	0	0	0	0	0			0	0
Potato aphid	0	0	0	0	1	0	3	0	0	5	1	4			0	0
Sunflower aphid	0	0	0	0	0	0	4	0	0	0	1	2			0	0
Thistle aphid	0	0	0	0	1	0	0	0	0	0	0	0			0	0
Turnip aphid	0	0	0	0	0	0	0	0	0	3	0	0			0	0
Cotton/melon aphid	0	0	0	0	0	0	8	3	0	4	1	1			8	3
Pea aphid	0	0	0	2	0	2	1	0	0	0	1	1			0	0
Cowpea aphid	0	0	1	0	2	0	0	2	0	1	0	0			4	0
Black bean aphid	0	0	0	0	3	0	0	0	0	0	0	2			0	0
Buckthorn aphid	0	0	0	0	0	0	0	0	0	0	0	0			0	0
Identified non-vectored species	0	0	3	3	1	3	7	2	0	4	3	0			2	1
Not ID'd	0	0	0	0	2	0	0	0	0	0	0	0			0	0
Total # captured	0	6	9	20	14	12	44	9	0	42	11	11	0	0	22	30
Total Vectors	0	6	6	17	11	9	37	7	0	38	8	11	0	0	20	29

September 1, 2013

Extreme vector numbers in some locations

Aphid in several locations showed very high catches in the past week. Traps at Walhalla (101) and Hoople (165) and Staples (102) recovered from 2x to 5x their cumulative season's catch in just 1 week! Other locations also trapping higher numbers of aphid vectors than in past weeks were Cando (13) and Forest River (65), and

Crookston (19). Gully recovered high numbers for the second week in a row (40). Non-vector aphid species were also numerous this week, indicating aphid dispersal was quite active.

Green peach aphids were recovered from only the trap in Cando while Soybean aphids were recovered Walhalla, Hoople, Forest River, Linton, Gully, Crookston and Staples. Soybean aphid is closely related to buckthorn aphid, sharing its overwintering host so it isn't surprising that buckthorn aphid was recovered from numerous locations as well (Walhalla, Hoople, Linton, Lake of the Woods, Gully, Crookston, Sabin and Staples).

Several sites will no longer be reported as the vines in the adjacent fields have been killed and are likely no longer attractive to aphid vector species.

Late season vector pressure is increasing and late season transmission of PVY is thought to account for much of the infection in the region. Vector pressure continues.

	Aphid Species Captured (rec'd Aug22-Aug28)															
	Cando ND	Wallhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Rec'd	27-Aug	27-Aug	27-Aug	22-Aug		28-Aug	28-Aug	27-Aug	27-Aug	29-Aug	26-Aug	27-Aug	26-Aug	26-Aug		22-Aug
Green peach aphid	1	8	0	0		0	0	0	0	0	0	0	0	0		0
Soybean aphid	0	4	4	2		0	1	0	0	3	8	0	0	0		7
Bird cherry oat aphid	4	9	18	4		0	4	0	0	6	4	1	0	1		1
Corn leaf aphid	0	8	1	0		0	3	0	0	0	0	0	0	0		0
English grain aphid	3	14	10	3		1	9	0	0	5	2	1	0	1		2
Green bug	0	0	0	0		0	0	0	0	0	0	0	0	0		0
Potato aphid	0	1	0	18		0	1	0	0	8	0	0	0	0		0
Sunflower aphid	0	14	11	0		0	1	0	0	2	0	0	0	0		9
Thistle aphid	0	0	0	0		0	0	0	0	0	0	0	0	0		0
Turnip aphid	2	0	0	1		0	0	0	0	0	0	0	0	0		0
Cotton/melon aphid	3	14	11	6		0	0	1	0	5	0	0	0	2		42
Pea aphid	0	1	0	1		0	0	0	0	0	0	0	0	0		0
Cowpea aphid	0	0	0	4		0	2	4	0	4	0	0	0	2		3
Black bean aphid	0	0	0	0		0	0	0	0	0	0	0	0	0		0
Buckthorn aphid	0	28	10	0		3	1	1	0	7	5	0	0	1		38
Identified non-vectored species	5	37	11	11		2	7	3	0	4	3	6	0	0		4
Not ID'd	0	0	0	0		1	0	0	0	0	0	0	0	0		0
Total # captured	18	138	76	50	0	7	29	9	0	44	22	8	0	7	0	106
Total Vectors	13	101	65	39	0	4	22	6	0	40	19	2	0	7	0	102

September 8, 2013

Aphid trap captures were lower in all locations but one.

We are getting later in the season but aphids are still flying; numbers are definitely down this week but both soybean and green peach aphids are making appearances in more locations. Aphid suction trap captures were lower than last week in all locations save Lake of the Woods (which had its largest capture to date, 40

vector species). Several locations, while down from last week, still had high numbers of aphid vectors; Hoople, Hatton and Forest River, ND captured 24, 19 and 32 vectors species (respectively) while the trap at the Staples location captured 16 aphids.

Some of the more important vector species were captured in higher numbers than they have been in previous weeks. Green peach aphids were recovered from Cando, Hoople and Crookston this week, while soybean aphids showed up in the traps at Cando, Hoople, Forest River, Hatton, Sabin, Perham and Staples. These may represent movement of soybean aphids back to Buckthorn (their overwintering host), Buckthorn aphids (closely related to soybean aphid) were also flying this week and were recovered in traps from Forest River, Hatton, Gully and Crookston. A relatively large flight of potato aphids was recovered from the trap at Hatton and cereal aphids were still present in numbers at several locations, over half of the aphids trapped this week in the Lake of the Woods trap were bird cherry oat aphids (24 of 40 captured). These may have been coming off turf grass and grass seed fields.

We continue to have an aphid year, so if you still have plants in the field that have not yet started to die back or have not yet been killed...

Aphid Species Captured																
	Cando ND	Wallhall a ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookstn MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Rec'd	4-Sep		4-Sep	30-Aug	6-Sep	5-Sep	6-Sep	4-Sep	5-Sep	6-Sep	6-Sep	6-Sep	3-Sep	29-Aug	4-Sep	26-Aug
Green peach aphid	1		3	0	0	0	0	0	0	0	1	0	0	0	0	0
Soybean aphid	3		5	16	1	0	0	0	0	0	0	0	0	4	4	9
Bird cherry oat aphid	0		6	4	0	2	5	24	0	5	0	0	0	0	0	0
Corn leaf aphid	0		1	0	0	0	0	0	0	0	0	0	0	0	0	0
English grain aphid	0		1	0	0	0	0	3	0	0	0	0	0	0	0	1
Green bug	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potato aphid	2		0	2	12	1	0	0	0	0	0	0	0	1	0	0
Sunflower aphid	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thistle aphid	0		0	0	0	0	0	0	1	0	0	0	0	0	0	0
Turnip aphid	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cotton/melon aphid	1		7	0	4	1	0	8	0	1	0	2	0	1	0	2
Pea aphid	0		1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cowpea aphid	0		0	5	0	0	0	5	0	0	0	0	0	0	0	4
Black bean aphid	0		0	0	0	0	0	0	0	0	0	0	0	2	0	0
Buckthorn aphid	0		0	5	2	0	0	0	0	1	2	0	0	0	0	0
Identified non-vectored species	7		14	9	36	2	1	3	0	5	5	0	0	1	1	0
Not ID'd	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total # captured	14	0	38	41	55	6	6	43	1	12	8	2	0	9	5	16
Total Vectors	7	0	24	32	19	4	5	40	1	7	3	2	0	8	4	16

September 15, 2013

Weekly trap catches were down in all locations with the exception of Walhalla, ND (this may represent two weeks of samples). A significant number of these were green peach aphids.

Trap catches appear to be decreasing, indicating aphid movement is slowing. Nights have been getting

colder and the movement of several species over the past two weeks may indicate many aphid vector species are moving to their overwintering hosts.

On notable exception to this general decrease in aphid populations is Walhalla, ND, which has effectively doubled its seasonal capture total in the past two weeks alone (102 vector species captured). As we did not receive a sample from Walhalla last week, this may indicate 2 weeks of capture. Approximately 10% of this capture were green peach aphids (11 total) although this was the only site to report this species this period. Also numerous were bird cherry oat aphids (18), thistle aphids (25), cotton/melon aphids (27), and buckthorn aphids (15). In addition there were numerous non-vector species in the trap indicating Walhalla had experienced significant aphid flight in the past 2 weeks. The two traps in Linton, ND recovered a total of 16 aphids between them and Gully, MN recovered 10.

The weekly total number of soybean aphids captured is down but they were still reported from 5 locations (Walhalla, both Linton site, Gully and Sabin).

Hopefully aphid captures will continue to decrease over the region over the next week. Several sites have already killed their adjacent fields so will no longer be reporting data.

	Aphid Species Captured (ID'd Sep 6 thru Sep 13)															
	Cando ND	Walhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookston MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Rec'd	9-Sep	10-Sep	11-Sep			11-Sep	11-Sep	11-Sep	11-Sep	11-Sep	10-Sep		6-Sep		12-Sep	
Green peach aphid	0	11	2			0	0	0	0	0	0		0	0	0	0
Soybean aphid	0	3	0			1	2	0	0	3	0		0	4	0	0
Bird cherry oat aphid	0	18	2			3	5	0	3	5	1		0	0	0	0
Corn leaf aphid	0	0	0			0	0	0	0	0	0		0	0	0	0
English grain aphid	0	2	0			0	0	0	0	0	0		0	0	0	0
Green bug	0	0	0			0	0	0	0	0	0		0	0	0	0
Potato aphid	0	1	0			0	0	0	0	0	0		0	0	0	0
Sunflower aphid	0	0	0			0	0	0	0	0	0		0	0	0	0
Thistle aphid	0	25	0			0	0	0	0	0	0		0	0	0	0
Turnip aphid	1	0	0			0	0	0	0	0	0		0	0	0	0
Cotton/melon aphid	0	27	2			0	0	0	0	0	0		0	4	0	0
Pea aphid	0	0	0			0	0	0	0	0	0		0	0	0	0
Cowpea aphid	0	0	0			0	0	0	0	0	0		0	0	0	0
Black bean aphid	0	0	0			0	0	0	0	0	0		0	0	0	0
Buckthorn aphid	0	15	0			0	3	1	0	0	2		0	0	0	0
Identified non-vector species	6	30	2			0	2	2	4	2	0		0	0	0	0
Not ID'd	0	0	0			0	0	0	0	0	0		0	0	0	0
Total # captured	7	132	8	0	0	4	12	3	7	10	3	0	0	8	0	0
Total Vectors	1	102	6	0	0	4	10	1	3	8	3	0	0	8	0	0

September 29, 2013

Weekly trap catches were down in all locations with green peach aphids being recovered in Hoople and Crookston. The season is shutting down and aphid flights of all species were down this week, including soybean aphids and Buckthorn aphids (both may already have made return flights to their overwintering host,

buckthorn). Trap reports are decreased as well; several sites have harvested and traps are out of the field.

In reviewing the seasonal cumulative trap catches, 7 sites had more than 100 total vector captures, 4 of these had over 200 total captures. Given past history of suction trap results, this would qualify as a high vector year.

Aphid Species Captured (samples ID'd to Sept 19)																
	Cando ND	Wallhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookston MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Date Rec'd	16-Sep		17-Sep	20-Sep						19-Sep	16-Sep		16-Sep		16-Sep	
Green peach aphid	0		1	0						0	1		0		0	
Soybean aphid	0		0	0						1	0		0		0	
Bird cherry oat aphid	0		1	3						3	0		0		0	
Corn leaf aphid	0		0	0						0	0		0		1	
English grain aphid	0		0	0						0	1		0		0	
Green bug	0		0	0						0	0		0		0	
Potato aphid	0		1	0						0	0		0		0	
Sunflower aphid	0		0	0						0	0		0		0	
Thistle aphid	0		1	0						1	0		0		0	
Turnip aphid	0		0	0						1	0		0		0	
Cotton/melon aphid	1		3	1						3	0		0		0	
Pea aphid	0		0	0						0	0		0		0	
Cowpea aphid	0		0	0						1	0		0		0	
Black bean aphid	0		0	0						0	0		0		0	
Buckthorn aphid	0		0	0						0	0		0		0	
Identified non-vectored species	1		0	1						0	1		0		0	
Not ID'd	0		0	0						0	0		0		0	
Total # captured	2	0	7	5	0	0	0	0	0	10	3	0	0	0	1	0
Total Vectors	1	0	7	4	0	0	0	0	0	10	2	0	0	0	1	0

October 13, 2013

What I would define as a high aphid number year has come to a close. Most trap locations had at least moderate total seasonal trap catch numbers and some much higher. There were 4 locations whose total seasonal trap catch exceeded 200 individual aphid vector; Walhalla, Hatton (which had close to 250), and the

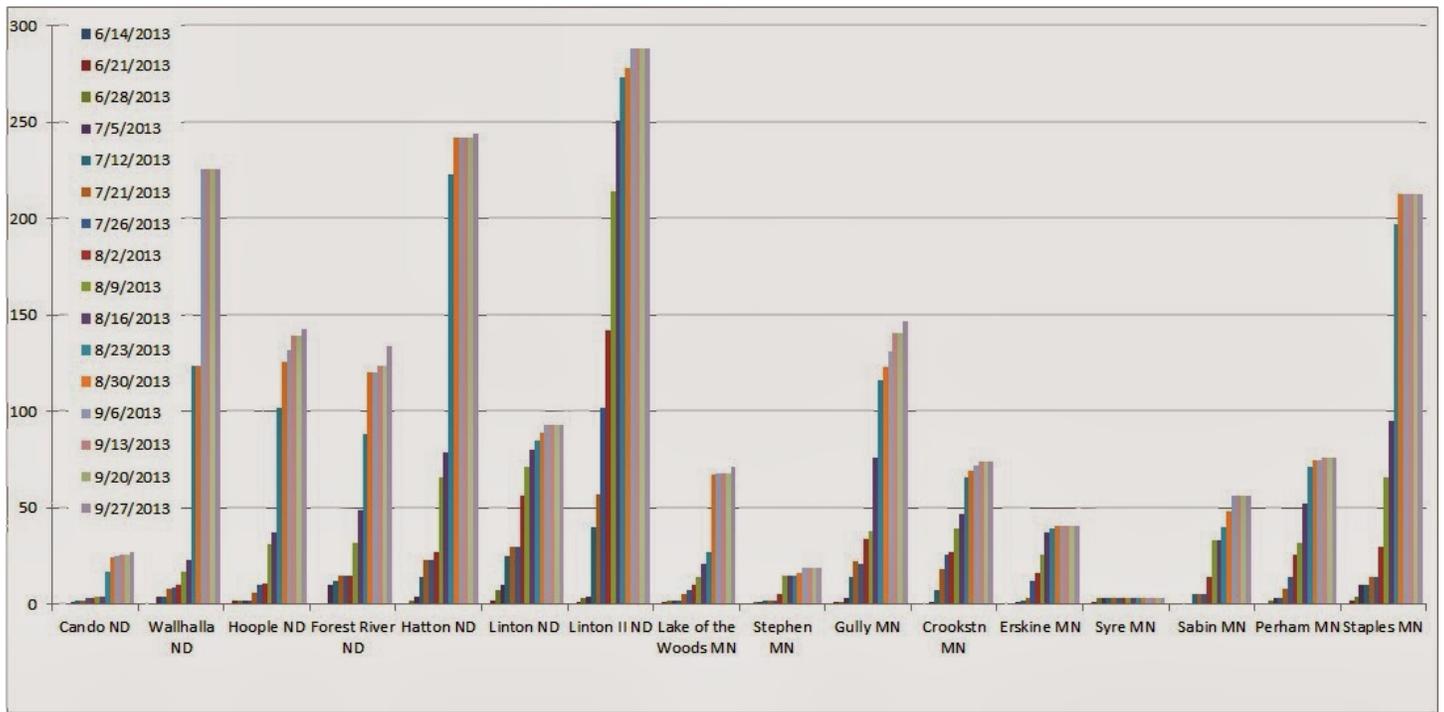
Linton II (which had close to 300) ND sites and Staples MN. Much of this resulted from later season flights. The Linton II trap had high aphid captures throughout most of the summer and then their numbers declined later in the season. Alternatively, most of the seasonal catch in the other 3 locations resulted from one or two very high weekly captures; in Hatton and Staples this was the sample period ending Aug 23, Walhalla had two significant flights during the Aug 23 period and then again 2 weeks later in the period ending Sept 6.

Many of the other sites also had high catch numbers; the Linton I site, Hoople and Forest River in ND and Gully in MN all captured close to or in excess of 100 individual aphid vectors. There were a number of sites that would be categorized as having moderate numbers of seasonal catch; Lake of the Woods, Crookston, Erskine, Sabin, and Perham MN all had seasonal captures of close to or exceeding 50 individual aphid vectors. The remaining sites (Cando ND, Stephen and Syre MN) all had lower capture numbers but traps there still recovered important vector species.

This year's results seem to support the idea that most of our aphid flight, and therefore most of our virus movement, occurs later in the season. The application of crop oil and antifeedant insecticides have potential to decrease virus movement within fields but it may be that killing vines prior to some of the heaviest aphid flights may also decrease the introduction and movement of inoculum. Given our late planting and drought conditions in many locations this season, this obviously would have been a difficult year to implement this tactic.

The Aphid Alert II network will be back next year, we are hoping to increase the number of traps and refine the resolution of our network. Thanks and appreciation are due to all of our cooperators - we are hoping you're willing to host again next year and we'll soon be in touch regarding storing and servicing the traps. I hope harvest went well for all.

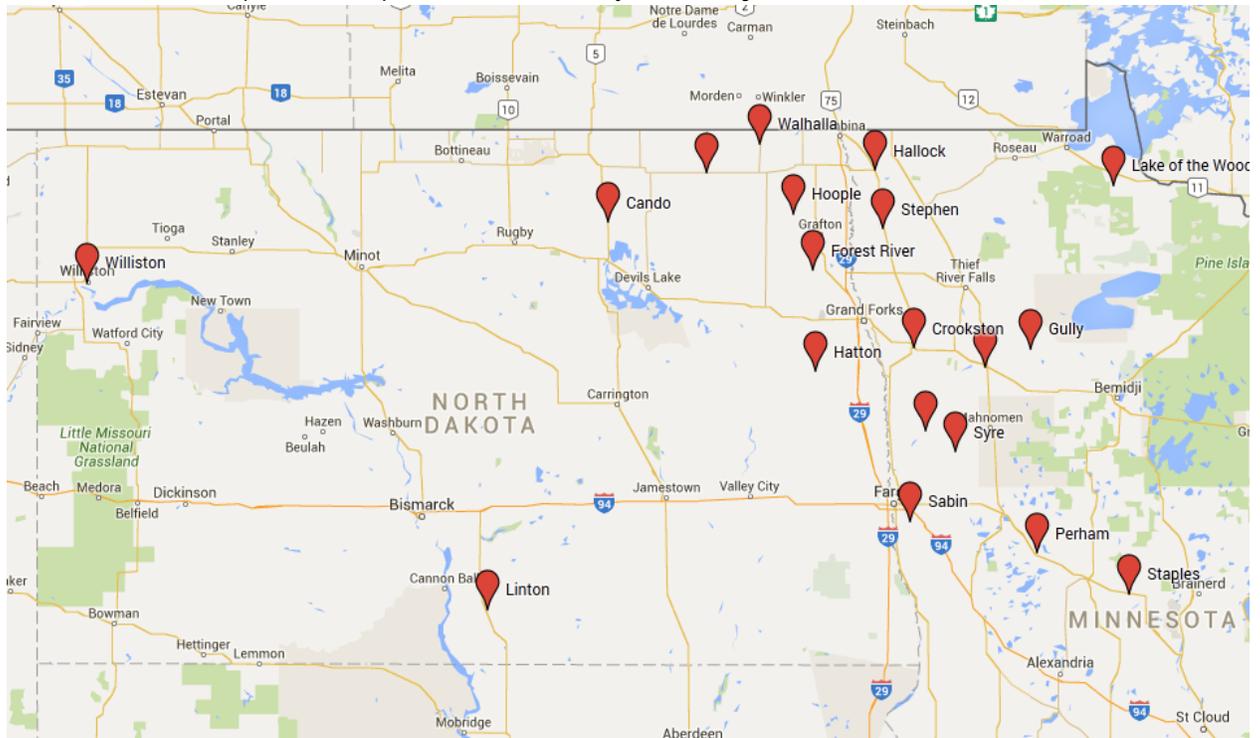
	Aphid Species Captured (per suction trap Jun 14-Oct 02)															
	Cando ND	Wallhalla ND	Hoople ND	Forest River ND	Hatton ND	Linton ND	Linton II ND	Lake of the Woods MN	Stephen MN	Gully MN	Crookston MN	Erskine MN	Syre MN	Sabin MN	Perham MN	Staples MN
Green peach aphid	2	19	8	3	11	0	4	0	0	0	3	0	0	0	1	1
Soybean aphid	3	8	10	23	21	3	13	2	1	9	21	0	0	8	17	23
Bird cherry oat aphid	6	31	41	25	32	15	45	25	3	48	6	5	0	6	3	27
Corn leaf aphid	0	9	2	0	6	6	13	3	0	2	0	2	0	0	3	2
English grain aphid	3	24	25	16	12	28	109	7	3	11	18	14	0	15	22	28
Green bug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potato aphid	2	2	1	22	56	5	12	1	0	21	1	5	0	1	6	2
Sunflower aphid	0	14	11	1	2	2	9	0	2	3	3	3	0	0	1	18
Thistle aphid	1	26	1	1	2	0	9	0	1	6	1	0	0	0	0	0
Turnip aphid	3	0	0	1	2	1	2	0	0	7	0	0	1	0	2	3
Cotton/melon aphid	6	41	25	8	31	7	24	15	0	15	4	3	0	7	10	51
Pea aphid	0	3	2	3	1	8	11	2	5	3	2	1	0	3	0	2
Cowpea aphid	0	2	6	13	29	8	20	13	4	10	1	1	2	2	4	15
black bean aphid	1	3	1	13	16	6	9	1	0	3	4	5	0	9	2	3
Buckthorn aphid	0	44	10	5	21	3	7	2	0	9	10	2	0	5	5	38
Identified non-vectored species	21	80	48	82	146	32	109	22	10	43	25	17	1	15	7	21
No ID'd	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0
Total # captured	48	306	191	216	390	125	397	93	29	190	99	58	4	71	83	234
Total Vectors	27	226	143	134	244	93	288	71	19	147	74	41	3	56	76	213



2014 Aphid Suction Trap Network Results

The Network

Twenty suction traps were emplaced next to potato fields in Minnesota and North Dakota during the 2014 growing season. Traps consisted of a 1.5 meter vertical PVC pipe housing a fan powered by a solar panel. The fan sucks passing insects into the trap and deposits them into a collection jar filled with a water / ethylene glycol mixture (antifreeze). Cooperators replaced collection jars weekly and mailed them to the lab for



identification and counting. Number of each species of aphid collected by location were posted to the web (<http://aphidalert.blogspot.com/>) and emailed to cooperators once or twice a week.

Results

A total of 3412 aphids representing 14 vector species were collected from June 22 through September 19. Of these, 2630 were vectors of PVY. Number of vector aphids varied widely by location with the Ada site collecting 535 vectors and the Syre site collecting only 3 vectors. Seven sites observed aphid numbers totaling more than 150 vectors at each site (Ada, Forest River, Crookston, Hatton, Stephen, Perham and Hallock). Seven sites collected between 50 and 150 vectors (Staples, Hoople, Sabin, Gully, Langdon, Walhalla and Erskine). Finally, six sites, collected less than 50 vectors throughout the season (Linton I and II, Lake of the Woods, Williston, Cando and Syre).

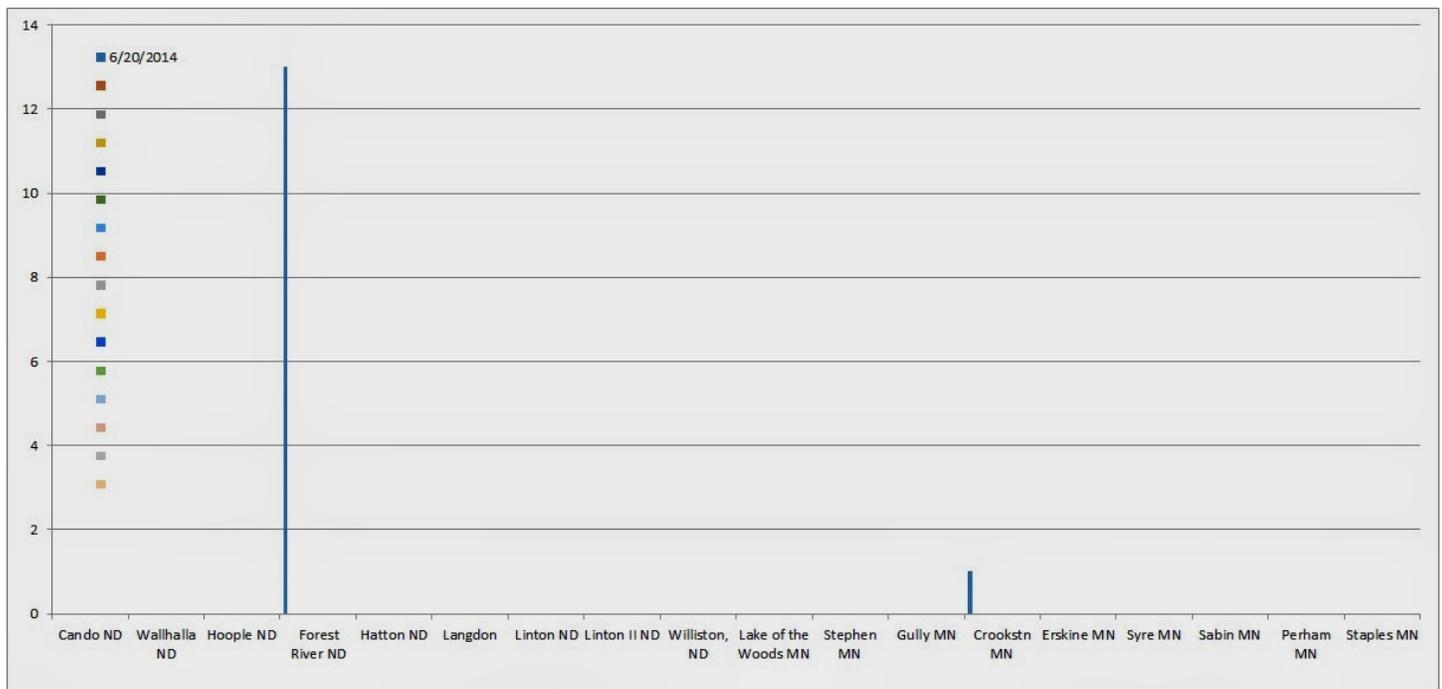
Aphid Alert Blog Posts from 2014

June 22, 2014

Welcome to the 3rd season of Aphid Alert II – assessing the weekly distribution of aphid vectors of Potato Virus Y in Minnesota and North Dakota. We added several sites this year and hope to expand to more than 20 sites for the season.

The first week's catch is in and identified.

Location	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid	Identified non-vector	Total # Captured	Total Vectors	
Cando, ND																				0
Crookston, MN												1							1	1
Forest River, ND												13						2	15	13
Hatton, ND																				0
Langdon, ND																				0
Linton 2, ND																		4		4



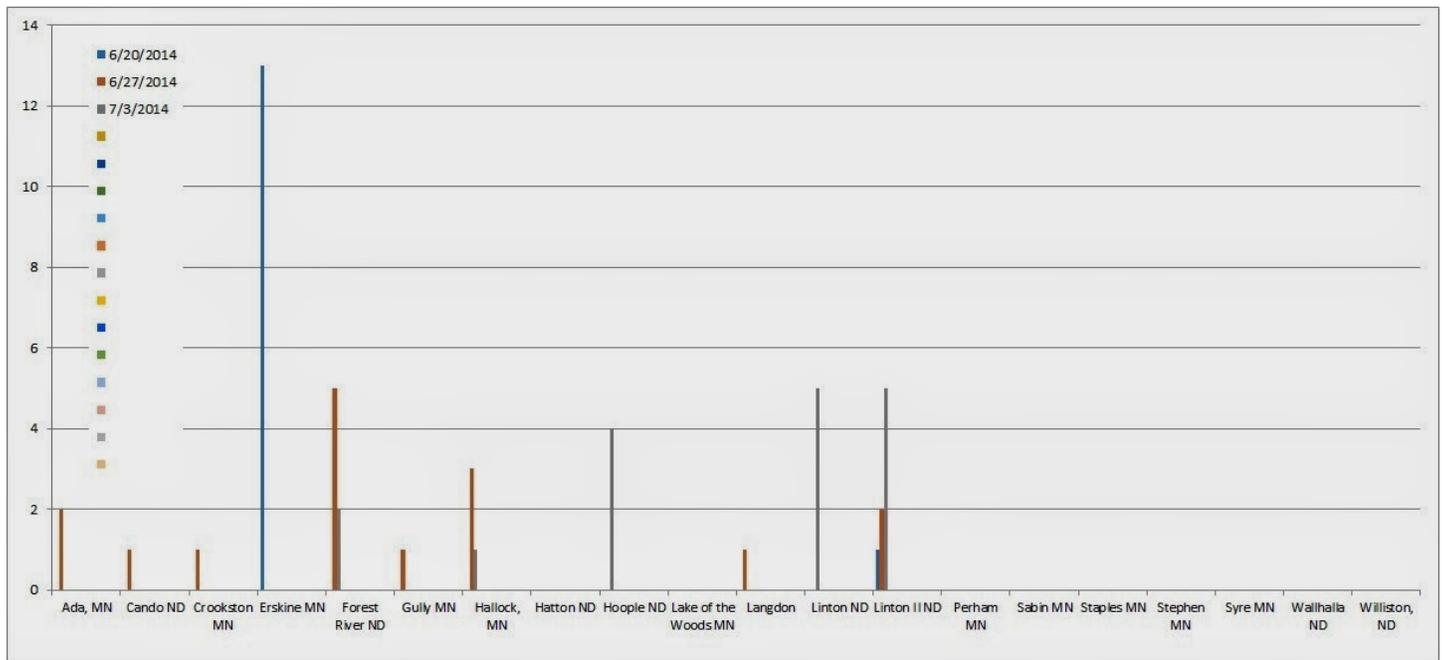
July 6, 2014

Here are the trap catches from the sites we received. Note that sites are on different schedules to send in trap catches (spreading out our identification workload). As more sites come in, we'll identify their trap catch and update the site on the fly.

A lone green peach aphid, the most efficient PVY vector, was collected from Hoople and Buckthorn aphid showed up at several sites. Overall though, aphid numbers remain low with no aphids collected at several sites.

By next week we hope to have all sites up and running in order to represent aphid populations across the entire seed potato growing regions of Minnesota and North Dakota.

Location	Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Tunip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckthorn aphid	Sugarbeet root aphid	Identified non-vector	Total # captured	Total Vectors
Ada, MN	1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cando, ND	1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Crookston, MN	30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erskine, MN	1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forest River, ND	30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	16	0	18
Gully, MN	1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Hallock, MN	30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	8	0	10
Hatton, ND	30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hoople, ND	30-Jun	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	5
Lake of the Woods MN																				
Langdon, ND	30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linton I, ND	1-Jul	0	0	0	0	2	0	0	0	0	0	1	0	0	0	2	0	2	0	7
Linton II, ND	1-Jul	0	0	2	0	0	0	0	0	0	0	0	1	0	1	1	0	7	0	12
Perham, MN	1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sabin MN																				
Staples MN																				
Stephen MN																				
Syre MN																				
Walhalla, ND	30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
Williston, ND																				



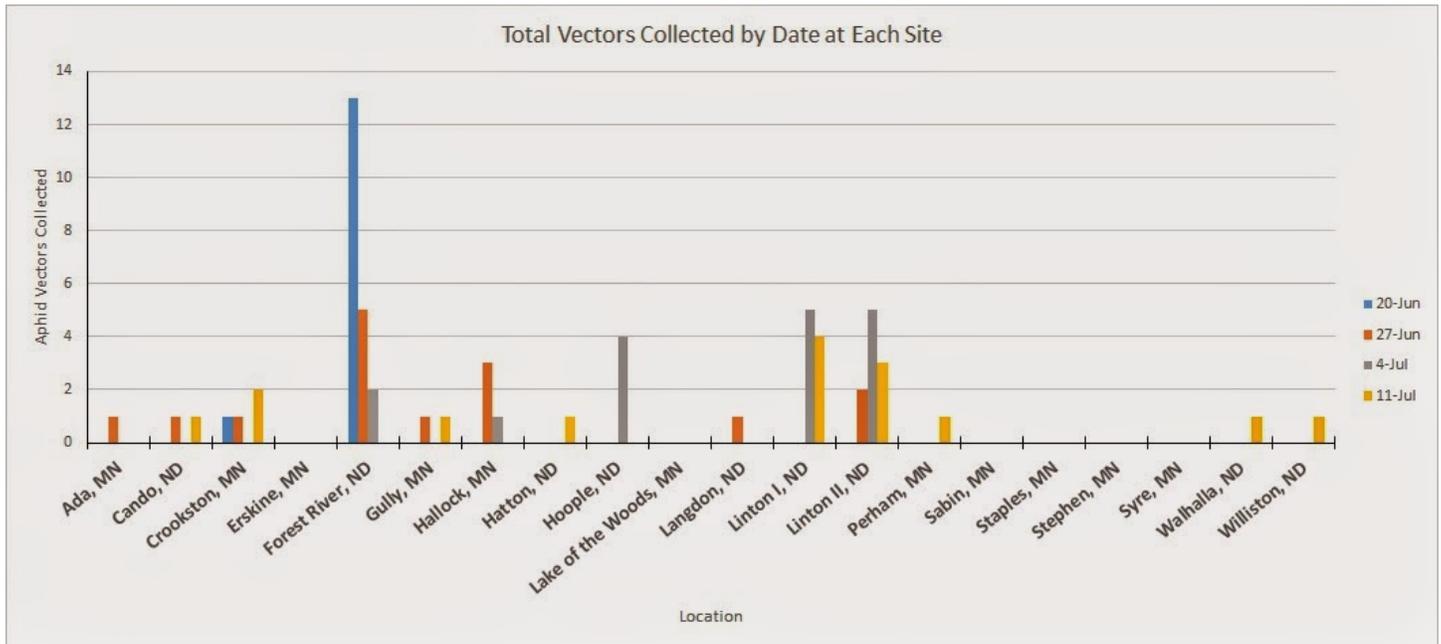
July 13, 2014

Here are the trap catches from the sites we received up to July 11. Note that sites are on different schedules to send in trap catches (spreading out our identification workload). As more sites come in, we'll identify their trap catch and update the site on the fly.

We're getting vectors at a few more locations but still seeing low numbers. Nine of the sites from which we received trap catches had at least one aphid vector. High counts were at our Linton sites with three and four vectors. Ada, Erskine, Forest River, Hallock, Hoople, Langdon, and Staples collected no vectors.

Species captured include buckthorn, bird-cherry oat, green bug, english grain, sunflower, cowpea, and pea aphids. These are all medium efficiency vectors.

Location	Week of	Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Identified non-vector	Total # captured	Total Vectors	
Ada, MN	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Cando, ND	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15	0	16
Crookston, MN	11-Jul	7-Jul	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	7	0	9
Erskine, MN	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forest River, ND	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	68
Gully, MN	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	3
Hallock, MN	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6
Hatton, ND	11-Jul	7-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	7
Hoople, ND	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
Lake of the Woods, MN	No Trap Received																				
Langdon, ND	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	12
Linton I, ND	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	6
Linton II, ND	11-Jul	7-Jul	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	9	0	12
Perham, MN	11-Jul	7-Jul	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Sabin, MN	No Trap Received																				
Staples, MN	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Stephen, MN	No Trap Received																				
Syre, MN	No Trap Received																				
Walhalla, ND	11-Jul	7-Jul	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	3
Williston, ND	11-Jul	3-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2



July 20, 2014

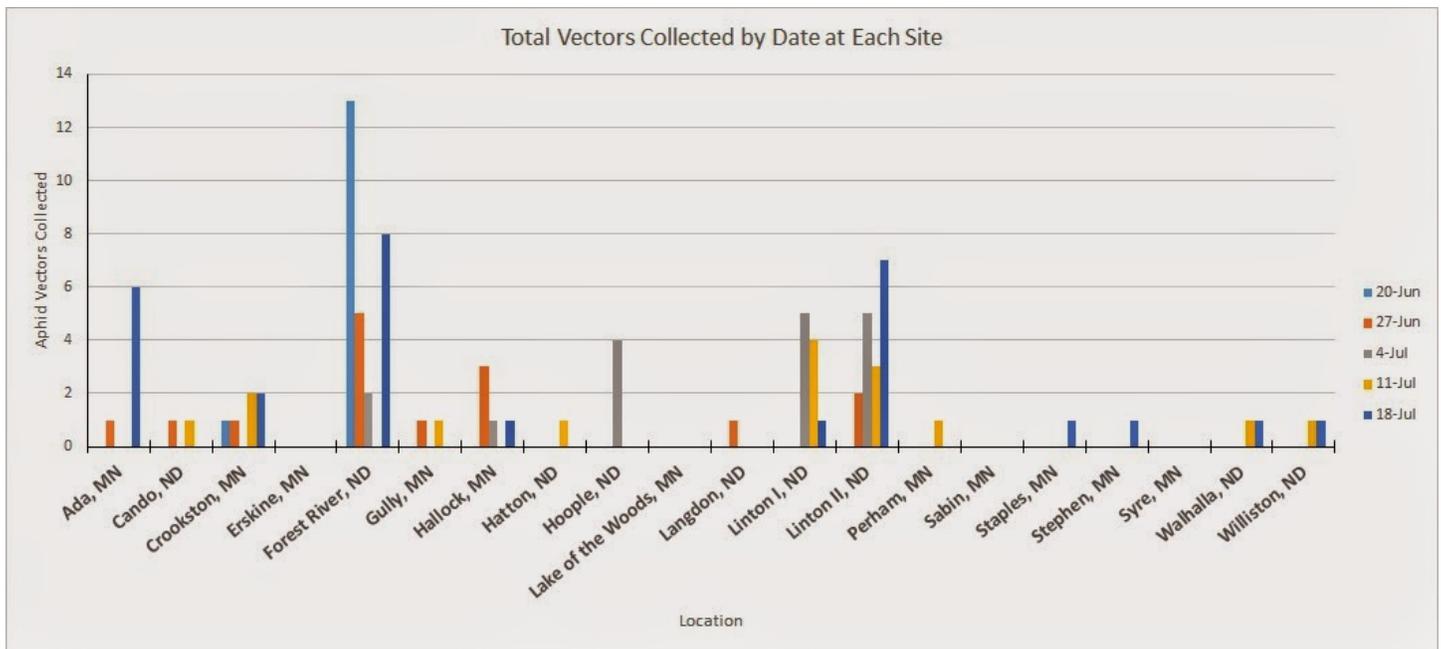
Here are the trap catches from the sites we received up to July 18. Note that sites are on different schedules to send in trap catches (spreading out our identification workload).

Nate reports there are higher number of aphid vectors at the Ada, Forest River, and Linton II sites this week. However, most sites are still seeing very low numbers of aphids. Overall numbers are low compared to data from the previous two years of this project and this is most likely due to the cool weather and rain we've had this summer. As temperatures increase we expect to see aphid numbers to increase as well.

Species included English grain aphid, cowpea and buckthorn aphids. No green peach or soybean aphids were recovered this week. Soybean aphid populations are low in northern MN and ND but are starting to establish in SW MN and this species is dispersed by wind.

So, until next week...

Location	Week of	Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckthorn aphid	Identified non-vector	Not ID'd	Total # captured	Total Vectors		
Ada, MN	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	0	8	6	
Cando, ND	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crookston, MN	18-Jul	14-Jul	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2	
Erskine, MN	18-Jul	13-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forest River, ND	18-Jul	14-Jul	0	0	0	1	3	0	0	0	0	0	0	0	0	0	4	40	0	0	48	8	
Gully, MN	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Hallock, MN	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1
Hatton, ND	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hoople, ND	18-Jul	15-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Lake of the Woods, MN	No Trap Received																						
Langdon, ND	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linton I, ND	18-Jul	14-Jul	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Linton II, ND	18-Jul	14-Jul	0	0	1	1	3	0	0	0	0	0	0	0	1	0	1	15	0	0	22	7	
Perham, MN	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sabin, MN	No Trap Received																						
Staples, MN	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
Stephen, MN	18-Jul	14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	1	1
Syre, MN	No Trap Received																						
Walhalla, ND	18-Jul	16-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
Williston, ND	18-Jul	13-Jul	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1



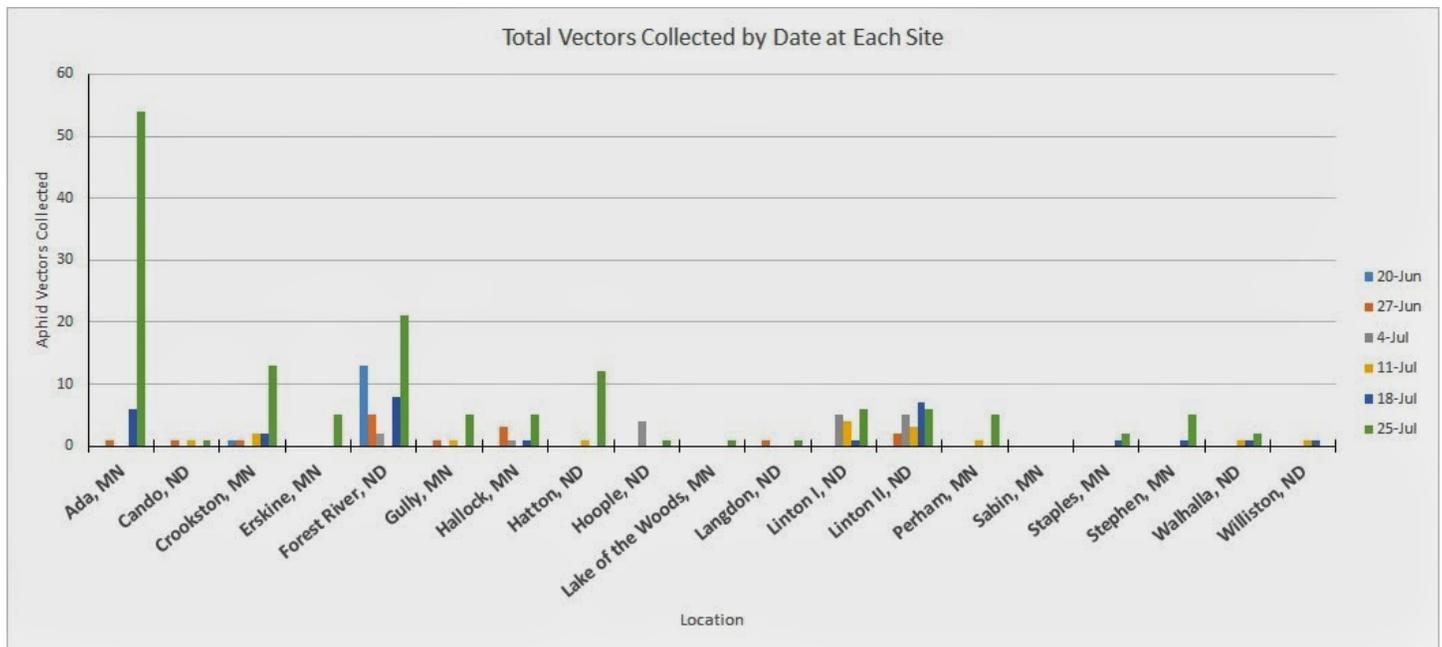
July 27, 2014

Here are the trap catches from the sites we received up to July 18. Note that sites are on different schedules to send in trap catches (spreading out our identification workload).

Nate reports that the warm weather has brought about higher aphid numbers, particularly in Ada, Crookston, Forest River, and Hatton. We've seen an increase in aphid numbers at almost all sites this week, although many sites still have very few aphids. Increased numbers have been mostly bird cherry oat aphid and green bug and probably represent aphids leaving maturing small grains in the region. Fortunately, we are still not seeing green peach or soybean aphid.

The Sabin trap has not been functioning correctly (the fan wasn't running). Make sure you are scouting in this area as we have not been able to get accurate counts. The problem has been fixed and next week's numbers should accurately reflect vector numbers in the area.

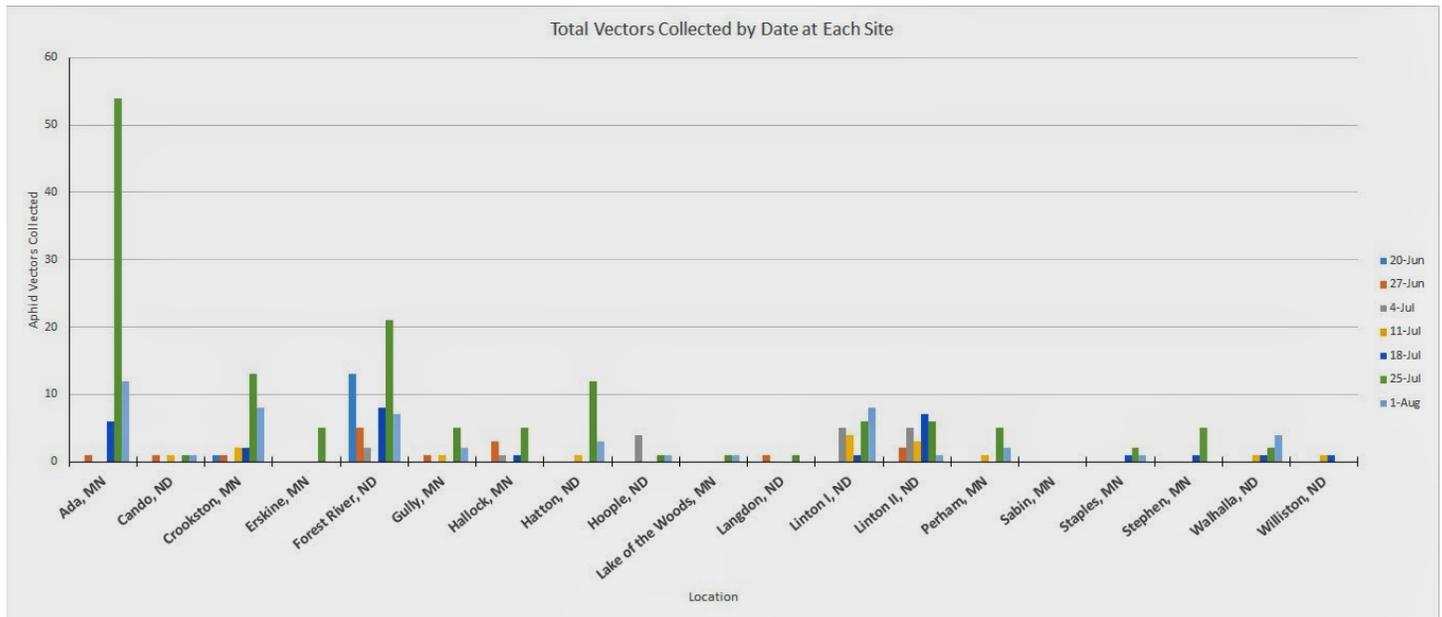
Location	Week of	Date Rec'd	Aphid Species															Total # captured	Total Vectors				
			Green peach aphid	Soybean aphid	Bird cherry oat	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckthorn aphid			Identified non-vector			
Ada, MN	25-Jul	21-Jul	0	0	49	0	1	4	0	0	0	0	0	0	0	0	0	0	0	5	0	60	54
Cando, ND	25-Jul	22-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1
Crookston, MN	25-Jul	21-Jul	0	0	4	1	1	7	0	0	0	0	0	0	0	0	0	0	2	0	25	13	
Erskine, MN	25-Jul	21-Jul	0	0	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5
Forest River, ND	25-Jul	21-Jul	0	0	19	0	0	2	0	0	0	0	0	0	0	0	0	0	89	0	113	21	
Gully, MN	25-Jul	21-Jul	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5
Hallock, MN	25-Jul	21-Jul	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	3	1	0	8	5	
Hatton, ND	25-Jul	21-Jul	0	0	5	1	0	6	0	0	0	0	0	0	0	0	0	0	2	0	23	12	
Hoople, ND	25-Jul	21-Jul	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1	
Lake of the Woods	25-Jul	21-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	
Langdon, ND	25-Jul	21-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Linton I, ND	25-Jul	21-Jul	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	4	0	13	6	
Linton II, ND	25-Jul	21-Jul	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	23	6	
Perham, MN	25-Jul	21-Jul	0	0	2	2	0	1	0	0	0	0	0	0	0	0	0	4	0	9	5		
Sabin, MN	25-Jul	18-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Staples, MN	25-Jul	21-Jul	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	
Stephen, MN	25-Jul	21-Jul	0	0	1	1	0	3	0	0	0	0	0	0	0	0	0	2	0	8	5		
Syre, MN	25-Jul	No Trap Received																					
Walhalla, ND	25-Jul	21-Jul	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	17	2		
Williston, ND	25-Jul	19-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0		



August 3, 2014

Aphid counts were down this week over last with only the Ada site reporting more than 10 vector species individuals. Even numbers of non-vector aphid species were down this week, indicating that aphid flights were suppressed but warmer temps, especially nights, may well drive numbers higher (or then again, maybe autumn is coming - nothing would surprise me about this summer!). Bird cherry oat aphids were again the most numerous vector species and was recovered from 13 of the 18 sites reporting. No green peach aphids or soybean aphids were recovered in any trap *but* green peach aphids were found in our greenhouse on potted potato plants. We suspect they were already present in low numbers and the warmer days increased their reproductive rate in the greenhouse.

Location	Week of Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry oat	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Identified non-vector	Total # captured	Total Vectors		
Ada, MN	1-Aug	28-Jul	0	0	11	0	0	1	0	0	0	0	0	0	0	0	0	1	0	14	12
Cando, ND	1-Aug	29-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Crookston, MN	1-Aug	28-Jul	0	0	4	0	1	3	0	0	0	0	0	0	0	0	0	4	0	15	8
Erskine, MN	1-Aug	28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Forest River, ND	1-Aug	28-Jul	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	18	0	26	7
Gully, MN	1-Aug	28-Jul	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Hallock, MN	1-Aug	28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hatton, ND	1-Aug	28-Jul	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	3	0	9	3
Hoople, ND	1-Aug	28-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Lake of the Woods, MN	1-Aug	28-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1
Langdon, ND	1-Aug	28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linton I, ND	1-Aug	28-Jul	0	0	6	1	0	1	0	0	0	0	0	0	0	0	0	1	0	9	8
Linton II, ND	1-Aug	28-Jul	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	6	1
Perham, MN	1-Aug	28-Jul	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	0	7	2
Sabin, MN	1-Aug	NS																			
Staples, MN	1-Aug	27-Jul	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	3	1
Stephen, MN	1-Aug	28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0
Syre, MN	1-Aug	NS																			
Walhalla, ND	1-Aug	28-Jul	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4
Williston, ND	1-Aug	28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0

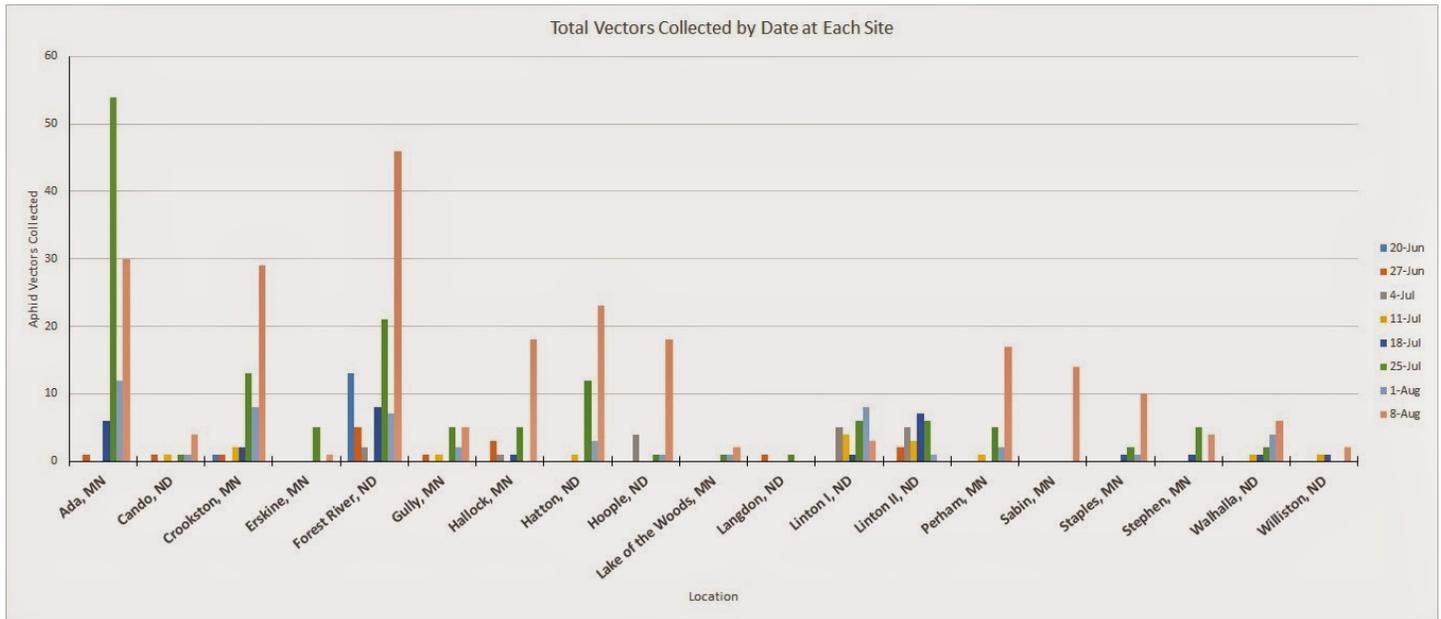


August 10, 2014

It looks like aphids are now moving into potatoes in earnest! We had large increases in almost all trap locations over last week. If you have not started aphid management, it's time to start! Nate reports that over all trap sites we collected 232 vectors this week compared to 51 last week. Aphid populations were high across the region and many locations recorded their highest vector numbers of the season. Only our Linton and Langdon sites saw fewer aphids this week. Bird cherry oat aphids continue to be our most caught species followed by green bug, english grain, and corn leaf aphids.

So far, no green peach or soybean aphid (despite soybean aphids being present in soybean fields in low numbers). If the weather starts to favor soybean aphid reproduction, we may yet see this species moving into seed potato fields!

Location	Week of Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid	Identified non-vector	Total # captured	Total Vectors			
																					Not ID'd		
Ada, MN	8-Aug	4-Aug	0	0	26	1	0	3	0	0	0	0	0	0	0	0	0	0	2	7	0	39	30
Cando, ND	8-Aug	5-Aug	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	5	4
Crookston, MN	8-Aug	4-Aug	0	0	2	5	5	6	2	2	2	2	2	0	1	0	0	0	9	4	0	42	29
Erskine, MN	8-Aug	4-Aug	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1
Forest River, ND	8-Aug	4-Aug	0	0	33	1	0	12	0	0	0	0	0	0	0	0	0	0	3	5	0	54	46
Gully, MN	8-Aug	4-Aug	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	6	5
Hallock, MN	8-Aug	4-Aug	0	0	10	0	0	8	0	0	0	0	0	0	0	0	0	0	0	5	0	23	18
Hatton, ND	8-Aug	4-Aug	0	0	6	0	1	8	0	0	0	0	0	0	8	0	0	0	4	0	0	27	23
Hoople, ND	8-Aug	4-Aug	0	0	9	1	0	8	0	0	0	0	0	0	0	0	0	0	1	3	0	22	18
Lake of the Woods, MN	8-Aug	4-Aug	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	5	2
Langdon, ND	8-Aug	4-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Linton I, ND	8-Aug	4-Aug	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	3
Linton II, ND	8-Aug	4-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	0
Perham, MN	8-Aug	4-Aug	0	0	11	0	0	6	0	0	0	0	0	0	0	0	0	0	1	7	0	25	17
Sabin, MN	8-Aug	4-Aug	0	0	8	0	0	0	0	0	0	0	0	0	6	0	0	0	2	1	0	17	14
Staples, MN	8-Aug	5-Aug	0	0	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	13	10
Stephen, MN	8-Aug	4-Aug	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	6	4
Syre, MN	8-Aug	No Trap Collected																					
Walhalla, ND	8-Aug	4-Aug	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	1	4	0	11	6
Williston, ND	8-Aug	3-Aug	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2

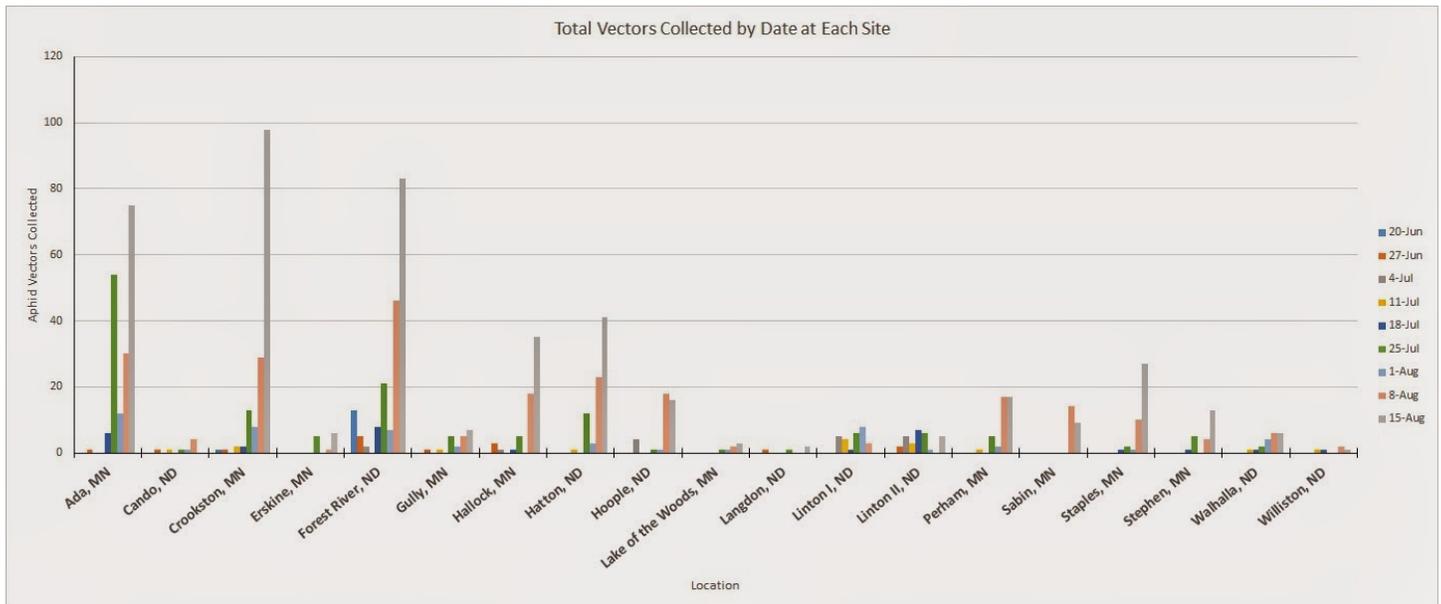


August 17, 2014

Vectors have nearly doubled this week with 18 sites reporting. 444 aphid vectors were collected this week as compared to 232 last week. Ada, Crookston, and Forest River had especially high numbers while Hallock, Hatton, and Staples recorded mid range numbers and the remaining were relatively low. Soybean aphid populations have begun to blossom in a few areas while bird cherry oat, corn leaf, and green bug continue to make up a majority of aphids captured. This week we also collected some green peach from Staples and Crookston. Remember that a lot of PVY transmission happens late season and high numbers of aphids are a large factor in this!

If you have not yet begun aphid management, it is important to do so.
So Keep Scouting!

Location	Week of Date Rec'd	Aphid Species																	Total # captured	Total Vectors		
		Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid	Identified non-vector	Not ID'd				
Ada, MN	15-Aug	11-Aug	0	21	32	8	1	7	1	1	0	0	0	4	0	0	0	0	11	0	86	75
Cando, ND	No trap received																					
Crookston, MN	15-Aug	11-Aug	3	25	4	31	1	25	0	4	0	0	1	4	0	0	0	9	14	0	121	98
Erskine, MN	15-Aug	11-Aug	0	0	2	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	6	6
Forest River, ND	15-Aug	11-Aug	0	24	10	0	0	46	0	2	0	0	1	0	0	0	0	1	10	0	94	83
Gully, MN	15-Aug	11-Aug	0	0	2	0	1	3	0	1	0	0	0	0	0	0	0	0	7	0	14	7
Hallock, MN	15-Aug	11-Aug	0	0	23	7	0	3	0	0	0	0	2	0	0	0	0	0	3	0	38	35
Hatton, ND	15-Aug	11-Aug	0	4	17	6	3	6	0	2	0	0	3	0	0	0	0	1	8	0	50	41
Hoople, ND	15-Aug	11-Aug	0	3	0	8	0	2	0	3	0	0	0	0	0	0	0	2	0	0	18	16
Lake of the Woods	15-Aug	11-Aug	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	2	0	5	3
Langdon, ND	15-Aug	11-Aug	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	1	0	4	2
Linton I, ND	15-Aug	11-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linton II, ND	15-Aug	11-Aug	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	5
Perham, MN	15-Aug	10-Aug	0	3	1	2	0	10	0	0	0	0	1	0	0	0	0	0	11	0	28	17
Sabin, MN	15-Aug	8-Aug	0	2	5	0	1	1	0	0	0	0	0	0	0	0	0	2	3	0	14	9
Staples, MN	15-Aug	11-Aug	1	1	11	14	0	0	0	0	0	0	0	0	0	0	0	1	1	0	29	27
Stephen, MN	15-Aug	11-Aug	0	1	9	1	1	1	0	0	0	0	0	0	0	0	0	0	5	0	18	13
Syre, MN	No trap received																					
Walhalla, ND	15-Aug	11-Aug	0	0	3	1	0	1	0	0	0	0	1	0	0	0	0	3	6	0	15	6
Williston, ND	15-Aug	10-Aug	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2	1



August 24, 2014

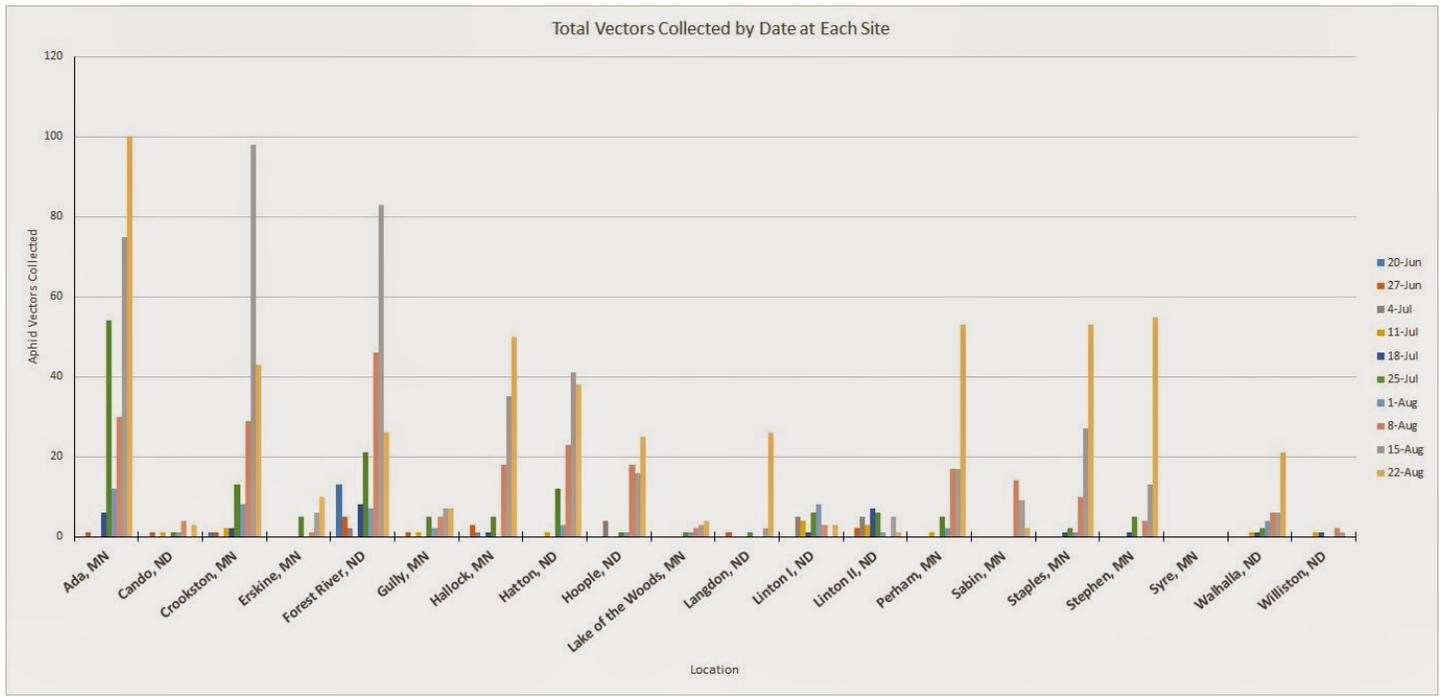
Aphid vector numbers were up for A THIRD WEEK IN A ROW! Probably because the temperatures last week were excellent for aphid reproduction and numbers were increasing. This may well have led to an increase in winged aphids, resulting in higher trap catches.

Trap catches increased at a number of locations over last week and decreased in some others. Numbers were up in Ada, Erskine, Hallock, Hoople, Langdon, Linton I, Perham, Staples, Stephen and Walhalla and down at other sites. Approximately 80 more aphids were recovered overall from all traps compared to last week.

Green peach aphids were recovered from Ada (2), Erskine (1), Forest River (3), Hatton (1), Langdon (3), Staples (1), Stephen (4), and Walhalla (1). Soybean aphids were recovered from Ada (29), Crookston (5), Erskine (4), Forest River (15), Hallock (2), Hatton (10), Hoople (3), Perham (27), Sabin (1), Staples (4), and Stephen (6). It looks like several locations received flights of soybean aphids. Other species captured at multiple locations in higher numbers included Bird cherry oat aphid, corn leaf aphid, greenbug and pea aphid.

Most of our PVY transmission in MN and ND occurs late in the season. Increasing aphid vector numbers is a prime driver in this. If you're in a position to do so, killing vines prior to or early in the arrival of the heaviest vector flights may be a management tactic to consider.

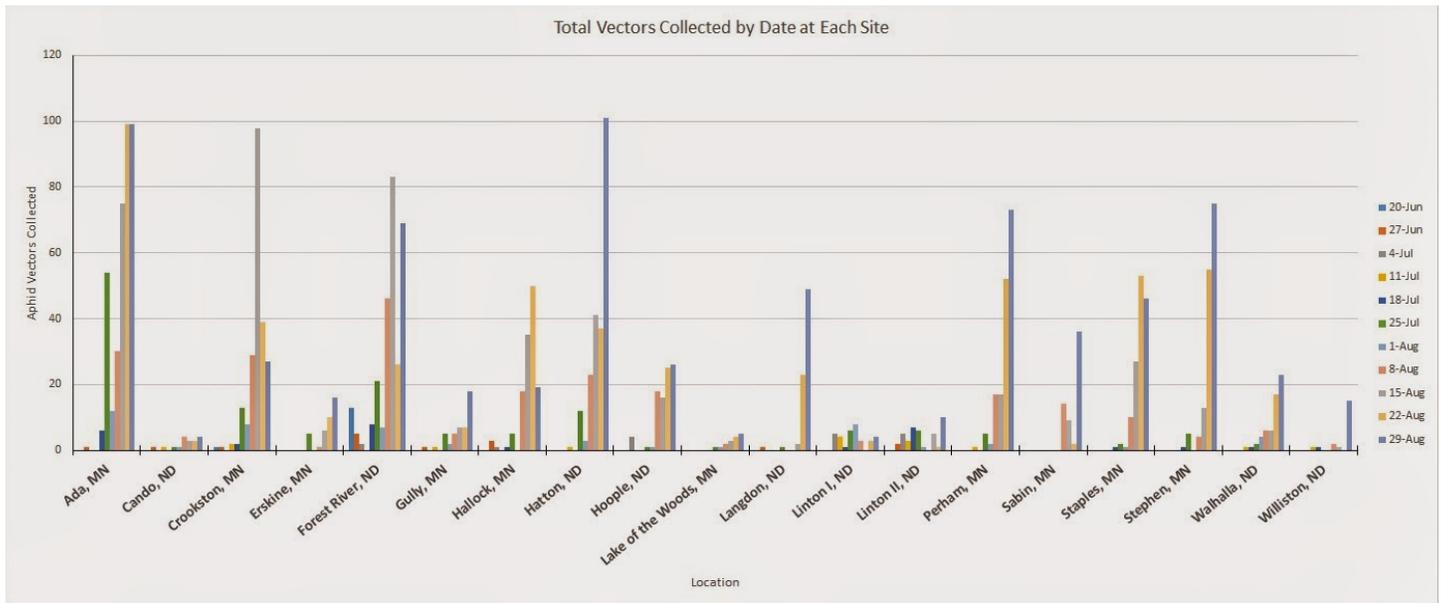
Location	Week of Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid	Identified non-vector	Not ID'd	Total # captured	Total Vectors	
Ada, MN	22-Aug	18-Aug	2	29	3	36	3	9	2	0	0	0	0	5	9	1	0	1	10	0	110	100
Cando, ND	22-Aug	19-Aug	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	2	0	5	3
Crookston, MN	22-Aug	18-Aug	0	5	1	24	0	7	1	0	0	0	0	1	0	0	0	4	4	0	47	43
Erskine, MN	22-Aug	18-Aug	1	4	1	2	0	0	0	0	1	0	1	0	0	0	0	0	3	0	13	10
Forest River, ND	22-Aug	18-Aug	3	15	1	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	26	26
Gully, MN	22-Aug	18-Aug	0	0	1	3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	7	7
Hallock, MN	22-Aug	18-Aug	0	2	8	22	0	13	0	0	0	0	0	2	0	3	0	0	11	0	61	50
Hatton, ND	22-Aug	18-Aug	1	10	4	14	1	6	0	0	0	0	0	1	0	0	0	1	6	0	44	38
Hoople, ND	22-Aug	18-Aug	0	3	7	6	1	3	0	0	0	0	0	2	0	3	0	0	2	0	27	25
Lake of the Woods, MN	22-Aug	18-Aug	0	0	1	0	0	2	0	0	0	0	0	1	0	0	0	0	5	0	9	4
Langdon, ND	22-Aug	18-Aug	3	0	0	5	7	6	0	0	0	0	0	2	0	0	0	3	4	0	30	26
Linton I, ND	22-Aug	21-Aug	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	4	3
Linton II, ND	22-Aug	21-Aug	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Perham, MN	22-Aug	19-Aug	0	27	3	4	1	14	0	0	0	0	0	0	0	2	1	1	16	0	69	53
Sabin, MN	22-Aug	16-Aug	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	2
Staples, MN	22-Aug	19-Aug	1	4	24	17	0	7	0	0	0	0	0	0	0	0	0	0	0	0	53	53
Stephen, MN	22-Aug	18-Aug	4	6	14	11	0	18	0	0	0	0	0	2	0	0	0	0	6	0	61	55
Syre, MN	22-Aug	no sample	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walhalla, ND	22-Aug	18-Aug	1	0	1	2	3	3	0	0	0	5	0	1	0	1	0	4	2	0	23	21
Williston, ND	22-Aug	no sample	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



August 31, 2014

Aphid numbers continue to climb this week with over 200 more aphid vectors collected this week as compared to last week. Twelve sites recorded their highest numbers of the season. We are seeing soybean aphids at most sites and high numbers of them at Ada, Perham, Forest River, and Sabin. Green peach aphid was recovered this week from Ada, Forest River, Hoople, Langdon, Perham, Staples, Stephen, and Walhalla. Lots of potential for virus transmission out there right now. Make sure you are making the right management decisions to keep your potatoes disease-free!

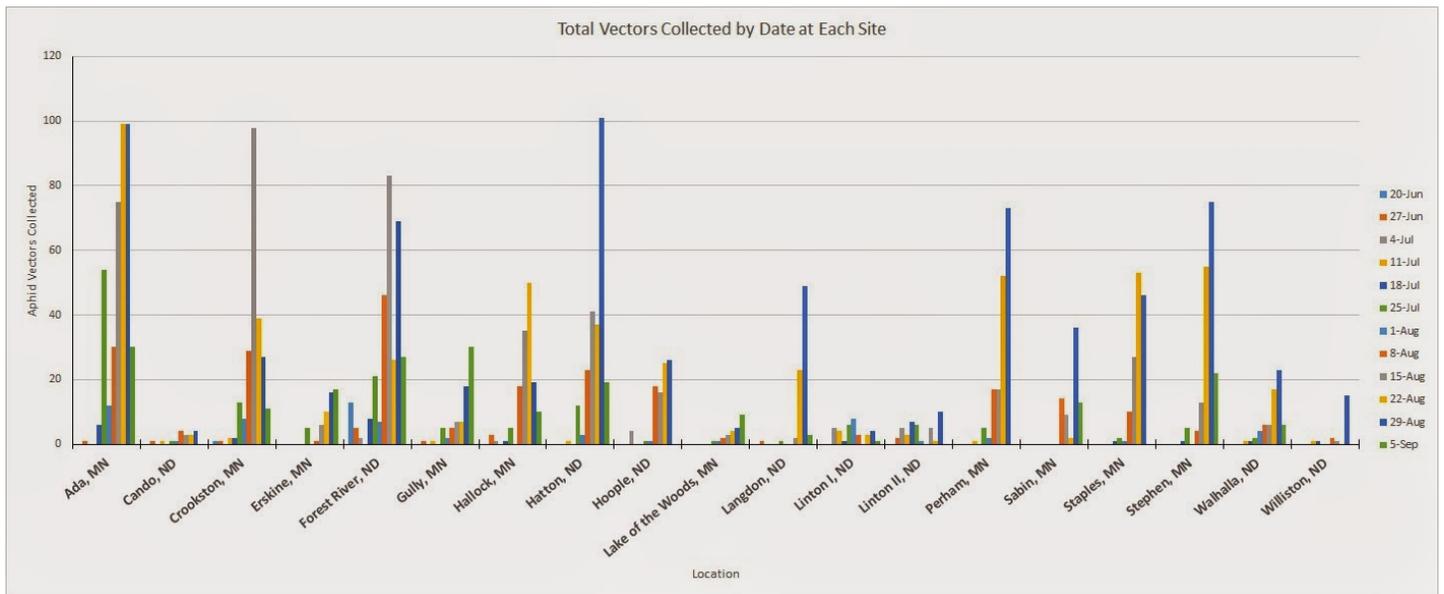
Location	Week of Date Rec'd	Aphid Species																Total # captured	Total Vectors				
		Green peach aphid	Soybean aphid	Bird cherry cat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Tump aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid			Identified non-vector			
Ada, MN	29-Aug	25-Aug	3	32	8	34	5	7	1	0	0	0	0	0	4	0	0	5	4	16	0	119	99
Cando, ND	29-Aug	28-Aug	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
Crookston, MN	29-Aug	25-Aug	0	14	2	7	0	2	0	0	0	1	0	1	0	0	0	0	1	4	0	32	27
Erskine, MN	29-Aug	25-Aug	0	8	0	2	0	2	1	0	0	0	0	2	0	0	0	1	0	7	0	23	16
Forest River, ND	29-Aug	25-Aug	2	23	5	12	4	23	0	0	0	0	0	0	0	0	0	1	12	0	82	69	
Gully, MN	29-Aug	25-Aug	0	2	2	8	2	3	0	0	0	0	0	1	0	0	0	0	6	0	24	18	
Hallock, MN	29-Aug	25-Aug	0	3	2	7	0	6	0	0	0	0	0	1	0	0	0	0	5	0	24	19	
Hatton, ND	29-Aug	25-Aug	0	15	21	22	13	26	0	0	0	0	0	1	0	0	3	0	5	0	106	101	
Hoople, ND	29-Aug	25-Aug	1	6	1	10	0	5	0	1	0	0	0	1	0	0	1	1	3	0	30	26	
Lake of the Woods, MN	29-Aug	25-Aug	0	2	0	2	0	1	0	0	0	0	0	0	0	0	0	0	7	0	12	5	
Langdon, ND	29-Aug	25-Aug	2	8	1	2	31	3	0	0	0	0	1	0	0	1	2	7	0	58	49		
Linton I, ND	29-Aug	25-Aug	0	0	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	4	4	
Linton II, ND	29-Aug	25-Aug	0	0	1	9	0	0	0	0	0	0	0	0	0	0	0	0	2	0	12	10	
Perham, MN	29-Aug	26-Aug	6	39	0	15	0	2	0	0	0	0	0	0	3	0	8	1	14	0	88	73	
Sabin, MN	29-Aug	22-Aug	0	21	3	7	1	4	0	0	0	0	0	0	0	0	0	0	0	0	36	36	
Staples, MN	29-Aug	28-Aug	4	5	0	24	0	0	0	0	0	0	2	5	0	6	0	6	0	52	46		
Stephen, MN	29-Aug	25-Aug	5	12	5	29	0	18	0	0	0	0	2	0	0	4	0	7	0	82	75		
Syre, MN	29-Aug	No Sample																					
Walhalla, ND	29-Aug	26-Aug	1	8	9	3	0	1	0	1	0	0	0	0	0	0	0	3	3	0	29	23	
Williston, ND	29-Aug	21-Aug	0	1	0	4	1	0	0	0	0	1	0	8	0	0	0	1	2	0	18	15	



September 7, 2014

The cooler weather has brought a decrease in aphid numbers this week. A total of 198 vectors were collected this week, a drop from over 700 last week. Fewer sites were reporting as some folks have begun to vine kill. We are continuing to see a lot of soybean aphid (87), bird cherry oat (29), and corn leaf (28). Green peach aphids were captured at Forest River, Gully, and Hallock.

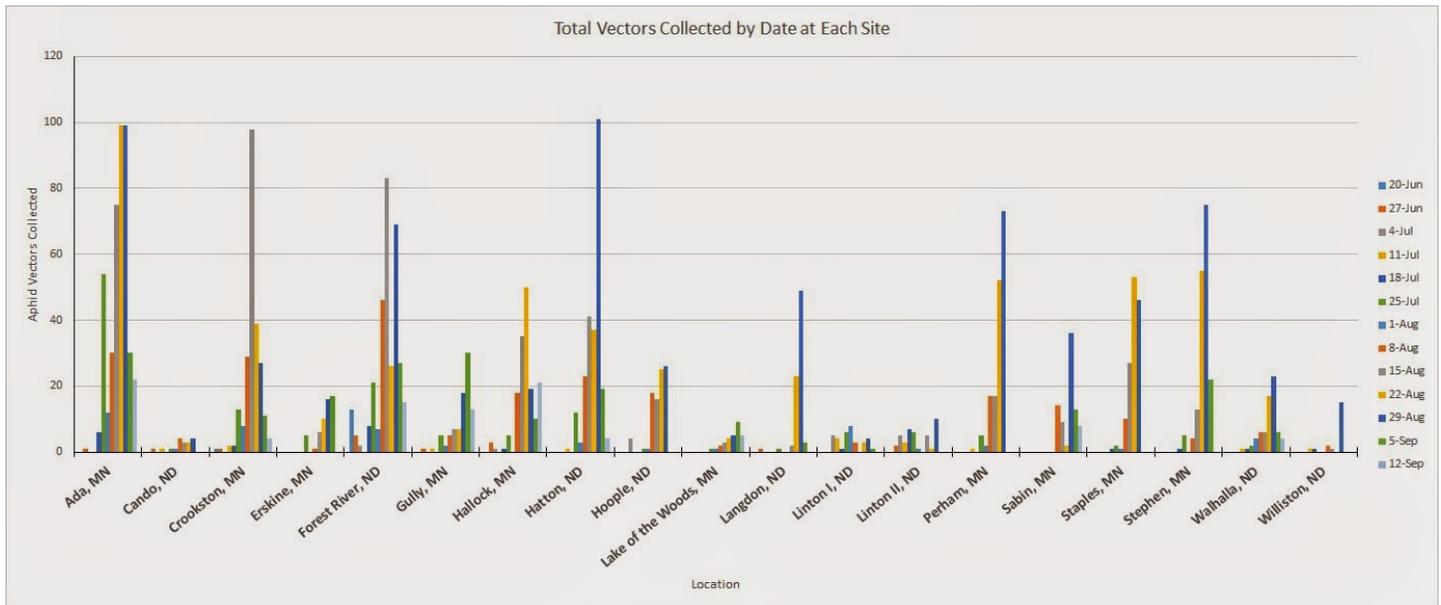
Location	Week of	Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green leaf	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid	Identified non-vector	Total # captured	Total Vectors		
Ada, MN	5-Sep	1-Sep	0	6	7	9	5	0	0	1	0	0	1	0	0	1	0	25	4	0	59	30
Cando, ND	No Trap Received																					
Crookston, MN	5-Sep	2-Sep	0	7	1	1	0	2	0	0	0	0	0	0	0	0	0	0	2	0	13	11
Erskine, MN	5-Sep	1-Sep	0	7	3	0	2	0	0	0	1	0	0	0	0	1	3	0	2	0	19	17
Forest River, ND	5-Sep	1-Sep	1	16	4	1	1	3	0	0	1	0	0	0	0	0	0	2	2	0	31	27
Forest River, ND	5-Sep	3-Sep	2	12	3	4	1	2	0	0	0	0	0	0	0	3	3	1	9	0	40	30
Gully, MN	5-Sep	1-Sep	2	3	0	3	0	2	0	0	0	0	0	0	0	0	0	0	8	0	18	10
Hallock, MN	5-Sep	1-Sep	0	12	1	2	2	1	0	0	1	0	0	0	0	0	0	1	0	0	20	19
Hatton, ND	5-Sep	1-Sep	0	12	1	2	2	1	0	0	1	0	0	0	0	0	0	1	0	0	20	19
Hoople, ND	No Trap Received																					
Hoople, ND	5-Sep	2-Sep	0	0	4	1	2	1	0	0	1	0	0	0	0	0	0	0	4	0	13	9
Lake of the Woods, MN	5-Sep	2-Sep	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	4	3
Langdon, ND	5-Sep	2-Sep	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	4	3
Linton I, ND	5-Sep	2-Sep	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Linton II, ND	5-Sep	1-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perham, MN	No Trap Received																					
Perham, MN	5-Sep	29-Aug	0	9	1	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	14	13
Sabin, MN	No Trap Received																					
Sabin, MN	5-Sep	1-Sep	0	12	3	3	1	1	0	0	1	0	0	0	0	0	1	2	0	0	24	22
Staples, MN	5-Sep	1-Sep	0	3	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	9	6
Walhalla, ND	5-Sep	1-Sep	0	3	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	9	6
Walhalla, ND	5-Sep	1-Sep	0	3	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	0	9	6
Williston, ND	No Trap Received																					



September 14, 2014

Aphid numbers continue to decrease with cooler temperatures. Majority of vectors captured are still soybean aphid and grain aphids. Fewer sites are reporting as people begin to vine kill and prep for harvest.

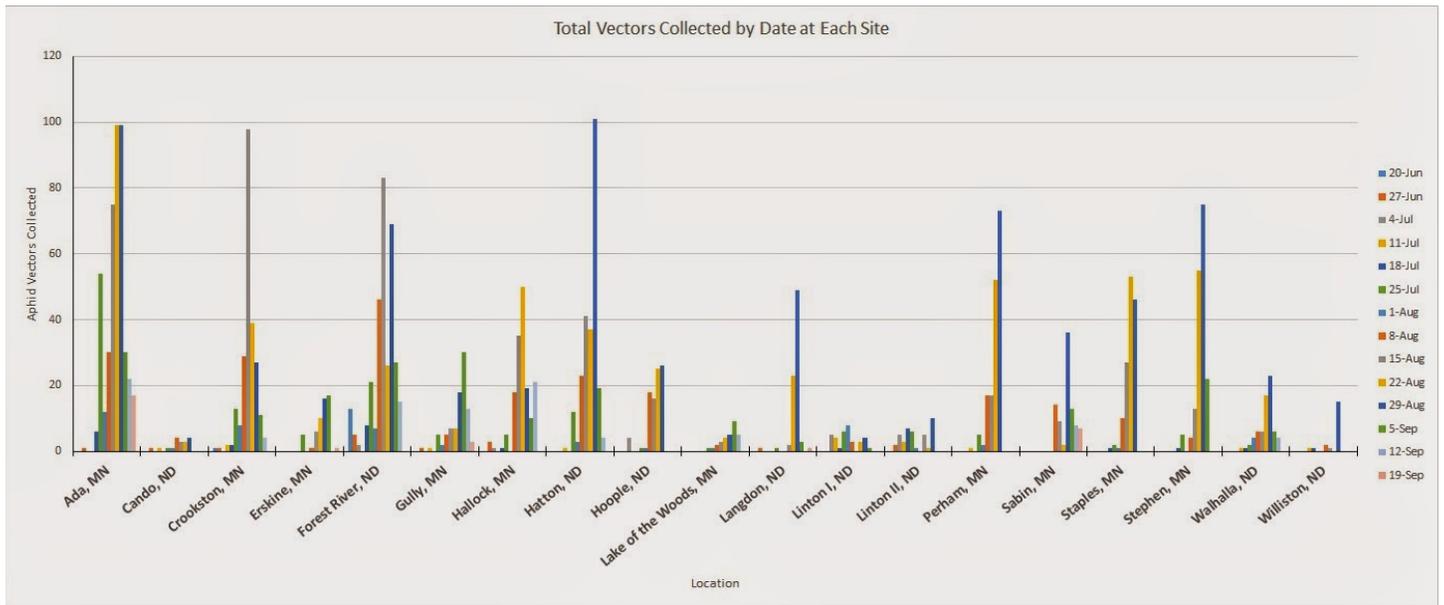
Location	Week of	Date Rec'd	Aphid Species															Total # captured	Not ID'd	Total Vectors			
			Green peach aphid	Soybean aphid	Bird cherry oat aphid	Corn leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid				Sugarbeet root aphid	Identified non-vector	
Ada, MN	12-Sep	8-Sep	0	9	1	4	7	0	0	0	0	0	0	0	0	0	0	1	26	16	0	64	22
Cando, ND	No Trap Received																						
Crookston, MN	12-Sep	8-Sep	0	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4	4
Erskine, MN	No Trap Received																						
Forest River, ND	12-Sep	8-Sep	1	7	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15
Gully, MN	12-Sep	9-Sep	0	8	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	20	0	33	13
Hallock, MN	12-Sep	8-Sep	0	8	2	4	3	0	1	0	0	0	0	0	0	1	2	0	4	0	4	25	21
Hatton, ND	12-Sep	8-Sep	0	0	2	0	0	0	1	0	0	0	0	0	0	0	1	1	1	4	0	9	4
Hoople, ND	No Trap Received																						
Lake of the Woods, MN	12-Sep	8-Sep	0	2	1	1	0	0	0	0	0	0	0	0	1	0	0	1	2	0	8	5	
Langdon, ND	12-Sep	8-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linton I, ND	No Trap Received																						
Linton II, ND	No Trap Received																						
Perham, MN	No Trap Received																						
Sabin, MN	12-Sep	6-Sep	0	5	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	9	8	
Staples, MN	No Trap Received																						
Stephen, MN	No Trap Received																						
Syre, MN	No Trap Received																						
Walhalla, ND	12-Sep	8-Sep	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	6	4	
Williston, ND	No Trap Received																						



September 21, 2014

Aphid numbers have declined throughout the region. Still seeing a few soybean aphid and stragglers of a few other species. Most areas are beginning to shut the traps down for the season. Thanks to all of our cooperators for their help this season!

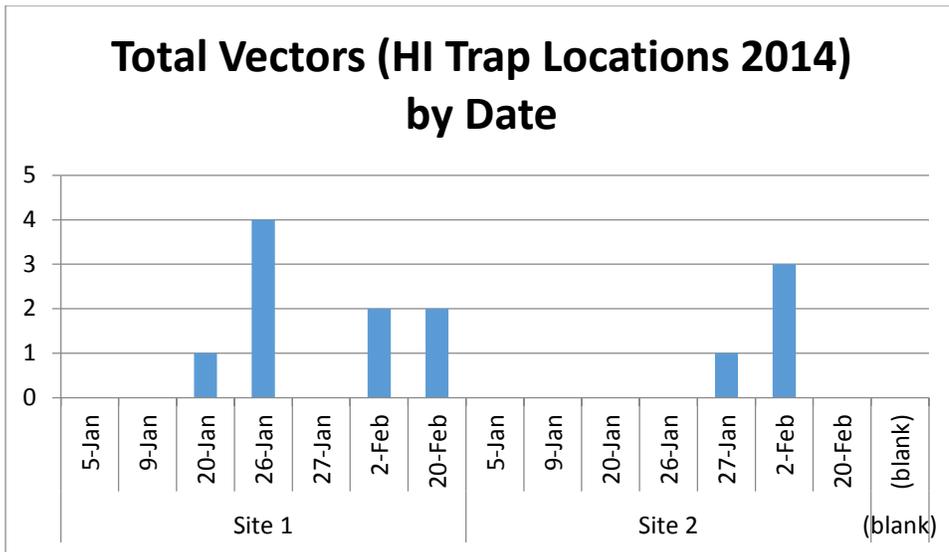
Location	Week of	Date Rec'd	Green peach aphid	Soybean aphid	Bird cherry cat aphid	Com leaf aphid	English grain aphid	Green bug	Potato aphid	Sunflower aphid	Thistle aphid	Turnip aphid	Cotton/melon aphid	Pea aphid	Cowpea aphid	Black bean aphid	Buckhorn aphid	Sugarbeet root aphid	Identified non-vector	Total # captured	Total Vectors		
Ada, MN	19-Sep	15-Sep	0	7	1	0	1	0	1	0	0	0	0	0	0	2	0	5	33	1	0	51	17
Cando, ND	19-Sep	Trap Received																					
Crookston, MN	19-Sep	16-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Erskine, MN	19-Sep	15-Sep	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1
Forest River, ND	19-Sep	Trap Received																					
Gully, MN	19-Sep	15-Sep	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	3
Hallock, MN	19-Sep	15-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hatton, ND	19-Sep	Trap Received																					
Hoople, ND	19-Sep	Trap Received																					
Lake of the Woods, ND	19-Sep	Trap Received																					
Langdon, ND	19-Sep	15-Sep	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Linton I, ND	19-Sep	Trap Received																					
Linton II, ND	19-Sep	Trap Received																					
Perham, MN	19-Sep	Trap Received																					
Sabin, MN	19-Sep	13-Sep	0	6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	8	7
Staples, MN	19-Sep	Trap Received																					
Stephen, MN	19-Sep	Trap Received																					
Syre, MN	19-Sep	Trap Received																					
Wahalla, ND	19-Sep	15-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Williston, ND	19-Sep	Trap Received																					



Summary table for season

	green peach aphid	soybean aphid	bird cherry oat aphid	corn leaf aphid	English grain aphid	green bug	potato aphid	sunflow er aphid	thistle aphid	turnip aphid	cotton/me lon aphid	pea aphid	cowpea aphid	black bean aphid	buckthorn aphid	sugarbeet root aphid	identified non-vector	total captured	total vectors
Ada, MN	5	104	138	92	23	31	5	2			1	13	11	2	17	91	74	609	535
Cando, ND			4	3	1	2					1		2		1		20	34	14
Crookston, MN	3	41	18	70	8	56	3	6	2	3	4	6	3			24	41	288	247
Erskine, MN	1	20	9	5	3	6	1		2		1	3		1	4	2	12	70	58
Forest River, ND	7	85	78	17	12	92		2	1		14			6	7	7	262	583	321
Gully, MN	3	23	17	16	6	11	1	1				2	3	4	1	4	47	135	88
Hallock, MN	2	16	44	43	3	33	1					5		4	7	1	51	210	159
Hatton, ND	1	41	57	45	20	54	1	2	1			5		4	8	8	34	273	239
Hoople, ND	2	12	20	26	2	18		4			3		3	1	4	4	15	110	95
Lake of the Woods, MN		4	9	5	2	5			1			2	1			2	23	54	31
Langdon, ND	5	9	3	7	39	11						3			2	7	25	111	86
Linton I, ND			15	4	2	4					1	1	2		6		12	47	35
Linton II, ND			18	10	3			1				1	1	1	3	1	62	101	39
Perham, MN	6	69	19	23	2	33					1		3	2	9	3	28	198	170
Sabin, MN		44	18	11	3	5							7		5	7	100	93	
Staples, MN	6	10	46	56	1	7						2	5		7	1	13	154	141
Stephen, MN	9	31	34	45	2	43						4		6	2	24	200	176	
Syre, MN		3															3	3	
Walhalla, ND	3	8	25	7	3	6		1	1	5		3		1	2	13	25	103	78
Williston, ND		1	1	5	2	1			1	1		9			1	7	29	22	
Total																	3412	2630	

2014/2015 Winter Grow-Out Summary Graph



Project 3

MN Specialty Crop Block Grant FINAL PERFORMANCE REPORT

This form is used to make a final report to MDA. It is due no later than 60 days following the end of your project.

Please submit electronically in MS Word format to Julianne LaClair at julianne.laclair@state.mn.us, or if accompanied by an invoice, to mda.accounts-payable@state.mn.us

Submitted by: Paul Hugunin

e-mail: paul.hugunin@state.mn.us

Date: 1-8-2016

PROJECT TITLE

17. Provide the project's title.

Market Expansion for Minnesota Specialty Crop Producers

USDA FY'12, MDA Contract #54769, 3(5)5953

October 12, 2012 to September 29, 2015

PROJECT SUMMARY

18. Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

The initial purpose of the project was to enhance the competitiveness of Minnesota specialty crop producers by improving marketing efficiency for growers, by making it easy for consumers to locate and purchase from specialty crop growers, and by educating children about the benefits of eating fresh locally grown produce. The project was designed to coordinate SCBG funds with the state's Minnesota Grown Program to avoid duplication and maximize the impact of federal and state resources. This proposal built on previous SCBG investments in the Minnesota Grown Directory, wholesale growers database, pay-per-click (PPC) advertising, and new point of sale

materials. Each of the following four activities addressed a specific issue affecting Minnesota's specialty crop growers:

- 1) Increase demand for Minnesota specialty crops by linking consumers with growers via the online Minnesota Grown Directory
- 2) As recommended by a previous SCBG funded project, use search engine optimization to increase the reach and efficiency of the online Minnesota Grown Directory
- 3) Develop and print point of sale materials to identify and promote SE Asian vegetables primarily grown and marketed by Hmong farmers
- 4) Increasing the demand for Minnesota specialty crops by educating children about the importance of eating fresh, locally grown produce

19. Establish the motivation for this project by presenting the importance and timeliness of the project.

Much of this project relates to utilization of web-based marketing tools such as websites, sponsored search campaigns and social media. These are not typically areas where small to medium size specialty crop growers excel. The role of the Minnesota Grown Program is to utilize its skills and resources to assist these producers by creating awareness of locally grown specialty crops and linking consumers directly with these producers. It is also important that we demonstrate to producers how they can implement many of the same techniques we use in their businesses. Not only have consumers shifted their primary source of information to web-based resources, within that category they are changing from fixed location personal computers to mobile devices such as phones and tablets. These trends were already beginning at the time this project was conceived and the changes accelerated throughout the project implementation phase.

20. If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

This project built on previously funded SCBG projects in several specific ways:

1. *Previous SCBG funded PPC campaigns helped increase the number of unique visitors on www.minnesotagrown.com from 18,650 in 2006 to 240,000 in 2011 and a previous SCBG project funded a pilot Facebook ad as a new form of PPC advertising. This project built on that success by continuing the use of PPC advertising (sponsored search) and by expanding on the Facebook ad pilot project to make Facebook advertising of specialty crops an ongoing part of our marketing mix.*
2. *A previous SCBG funded project enabled the MGPG to engage a company that specializes in search engine optimization to make recommendations for improving our ranking. This project allowed us to implement several of their suggestions, including incorporation of keywords into the URL's for each page of results. For example, when a consumer searches for apples, the URL of the results page now includes the word "apples" in order to appeal to search engines. We've also changed page titles, updated meta tags, and optimized landing pages for specific crops such as apples, strawberries, and Christmas trees.*
3. *Previous SCBG efforts funded development of SE Asian vegetable ID cards that include a photo, tips for use/storage on the front and a recipe on the back. These cards have been available to Hmong growers on tear-off pads of 50 cards each so the growers can provide them directly to customers. This project built on that effort by allowing us to design and produce laminated price cards for each of these vegetables. The result is a reusable, weather resistant, professional pricing card for Hmong growers.*

PROJECT APPROACH

21. Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

To accomplish the goal of increasing demand for Minnesota specialty crops by linking consumers with growers via the online Minnesota Grown Directory we undertook the following activities and tasks:

- We conducted a pay-per-click campaign on internet search engines including Google, Yahoo, and Bing.
- We conducted a pay-per-click campaign (including Facebook ads and sponsored posts) on the social media platform Facebook.
- All of these activities were specific to specialty crops. Although the number of unique visitors decreased during the first half of 2013 due to a very cold and late arriving spring, once warmer weather arrived and produce began ripening our traffic increased significantly. July, August, September, October and November of 2013 each set records for the number of unique visitors in their respective months. As a result, the number of unique visitors through the first 11 months of 2013 was up 18% compared to the first 9 months of 2012. PPC advertising results after November, 2013 are included in the MGPG's federal fiscal year 2013 project.
- Because PPC advertising is specific to a given set of keywords, we can ensure that SCBG funds are only used to promote eligible specialty crops. For example, people searching for "apples" are shown our ad promoting Minnesota Grown apples and are taken to our online Directory only if they click on the ad for apples. The MGPG uses PPC for promotion of non-specialty crops but they pay for that advertising directly with their own funds.

To accomplish the goal of using search engine optimization to increase the reach and efficiency of the online Minnesota Grown Directory we undertook the following activities and tasks:

- We moved the entire www.minnesotagrown.com website off of State of Minnesota (MDA) servers to a privately hosted site. The main advantage of this is to maintain SEO-friendly URL's on each page. The "old" site was hosted on two separate state servers, resulting in URL's that were not well received by search engines. For example, all web pages that included database search functions (Directory pages), were housed on a server with a URL beginning with "www3.mda.state.mn.us". All non-Directory pages started with "www.mda.state.mn.us". Search engines prefer consistent URL's within a single website.
- Other major SEO activities included:
 - integrating more landing pages for specific produce items,
 - fully integrating social media into the home page, and
 - ensuring that page titles, keywords, alt-tags, and other coding are optimized from a search engine perspective.
- As a reminder, our online Directory includes a small percentage (just under 20%) of non-specialty crop farmers. To account for this given USDA's strict interpretation of the eligible activities, the MGPG pays 20% of the cost of all web improvements within this project.

To accomplish the goal of developing, printing and distributing point of sale materials to identify and promote SE Asian vegetables primarily grown and marketed by Hmong farmers we undertook the following tasks and activities:

- Our original partner for this portion of the project was The Minnesota Project, well-known non profit organization with extensive experience working with Hmong farmers. They were instrumental in a previous SCBG project that included development of tear-off cards for SE Asian vegetables. Unfortunately, during implementation of this portion of the project, The Minnesota Project ceased to exist. This caused a substantial delay in this portion of the project.
- Seeking a new partner to assist with connection to Hmong farmers. We were very pleased to partner with the Hmong American Farmers Association. Although the loss of The Minnesota Project caused a delay, the partnership with HAFA will be tremendous asset to our efforts.

- *Designing the series of cards – one card for each of nine different vegetables*
- *Seeking bids and selecting a printer*
- *We printed 4,000 copies of each of nine unique SE Asian Vegetables for a total of 36,000 cards*
- *Beginning distribution of the cards to Hmong farmers via HAFA.*

To accomplish the goal of increasing the demand for Minnesota specialty crops by educating children about the importance of eating fresh, locally grown produce we undertook the following tasks and activities:

- *Minnesota Governor Mark Dayton declared October to be Farm to School Month in Minnesota.*
- *To help create awareness of Farm to School Month, Minnesota Grown spokesperson and former US Olympian Carrie Tollefson visited several schools around the state to talk with K-12 students about the importance of eating fresh, locally grown produce.*
- *To promote local apples, Carrie Tollefson was featured in a video produced by Minneapolis Public Schools promoting the Apple Crunch event. During the event, students all bite into a locally grown apple at the same time. This is a part of an event with participating schools throughout the upper Midwest.*
- *To create positive imaging for local produce in cafeterias, we developed a poster of Carrie Tollefson with a local farmer and food service staff. These posters will distributed to schools for use in the cafeteria.*

22. Present the significant contributions and role of project partners in the project.

The Minnesota Grown Promotion Group (MGPG) and the Minnesota Department of Agriculture (MDA) are the primary organizations involved in the project. The MDA provides the staff time needed to implement the project on a day to day basis. The MGPG provides the producer level input and monitoring to ensure that the project meets the needs of specialty crop growers. The MGPG includes representation from the statewide producer associations of apples, Christmas trees, grapes, honey, landscaping crops (trees, shrubs and flowers), produce growers who market via farmers markets, and produce growers who market to grocery stores, schools and restaurants. Early in the project, we partnered with the Minnesota Project, a non-profit organization with expertise working with immigrant farmers. During the implementation of the project, that organization ceased to exist. Although delayed, we regrouped and partnered with the Hmong American Farmers Association (HAFA) and will continue to work with them to foster long-term relationships with Hmong specialty crop growers.

GOALS AND OUTCOMES ACHIEVED

23. Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.
- See #5 above for a listing of activities for each goal.*
24. If outcome measures were long term, summarize the progress that has been made towards achievement.
- Developing relationships with Hmong farmers is extremely challenging work but it is crucial in order to have the marketing resources utilized by them. The language barrier is still problematic in many cases but overcoming the Hmong farmers' reluctance to partnering with government programs like Minnesota Grown is a long term issue. Our new collaboration with the Hmong American Farmers Association is a key step toward future success.*
 - Technology is ever-changing and changes in technology require ongoing investments in programming. With the assistance of USDA's Specialty Crop Block Grant program, we made several improvements to our website that will pay long-term dividends. The decision to move to a responsive design proved to be the right move and has put us in a strong position to serve a consumer base that increasingly uses smart phones and tablets to access the internet.*
 - Search engine optimization is definitely a long-term commitment. Search engines continuously modify their algorithms and guidelines, forcing web developers to continually evaluate their performance on*

various search engines. This project allowed us to make major strides toward improving our search engine optimization strategy. Changing our URL format, incorporating social media on our home page, developing consistent processes for keywords and metatags are all important outcomes toward long term success.

25. Provide a comparison of actual accomplishments with the goals established for the reporting period.

Measurable Outcome #1

- **GOAL:** To increase the number of consumers visiting the online Directory and to increase the likelihood that they will purchase Minnesota Grown specialty crops as a result of their visit.
- **PERFORMANCE MEASURE:** Using Google Analytics, we will measure the number of unique visitors to www.minnesotagrown.com. We can also measure how many came from PPC, unpaid search engine results, via links from other sites, and how many came directly to the site without using a link or a search engine.
- **BENCHMARK:** In calendar year 2012, we received 222,000 unique visitors.
- **TARGET:** Our goal was to have a 10% increase in the number of unique visitors.
- **Actual:** We exceeded our goal. Through November of 2013, the number of unique visitors increased by 18%.

Measurable Outcome #2

- **GOAL:** To increase the number of unique visitors to the www.minnesotagrown.com website who find the site using unpaid search engine results.
- **PERFORMANCE MEASURE:** Using Google Analytics, we will track the number of unique visitors who find the site using unpaid search engine results.
- **BENCHMARK:** To establish a relevant benchmark, we will tally the number of unique visitors who visit www.minnesotagrown.com for the six months prior to the implementation of our new SEO strategies and coding. We will compare that to the six months immediately following implementation.
- **TARGET:** We expect to double the average monthly total of unique visitors who come to the site via unpaid search engine results.
- **Actual:** The new SEO friendly website went live on August 19, 2014. We are using Google Analytics to capture comparative data regarding organic search traffic and other qualitative measures to compare the old site to the new site. Comparing Oct – December of 2014 (new SEO friendly site) vs Oct – Dec 2013 (old site) shows that we've more than doubled the traffic from unpaid search engine results. The number of visits from unpaid search engine results in October – December of 2013 was 11,404. October – December of 2014 received 26,227 visits from unpaid search engines. Google saw the biggest jump, going from 5,920 visits during the last three months of 2013 to 16,280 visits during the same three months in 2014.

Measurable Outcome #3

- **GOAL:** To provide Hmong farmers with attractive promotional materials that will help them market SE Asian vegetables to customers at farmers markets and grocery stores.
- **PERFORMANCE MEASURE:** We will track both the number of Hmong farmers using the cards and the number of ID cards distributed.
- **BENCHMARK:** The number of Hmong farmers who used the first series of cards is 12. The benchmark number of cards distributed is 3,600.
- **TARGET:** To distribute no less than 35,000 cards to at least 75 Hmong farmers.
- **Actual:** We printed a total of 36,000 cards (4,000 each of 9 different SE Asian vegetables). We have only distributed a portion of them to date but we have recently formed a collaborative effort with the Hmong American Farmers Association to help connect with Hmong farmers and we will continue to promote use of the cards and distribute them to interested growers.

Measurable Outcome #4

- **GOAL:** *To increase the number of K-12 students who participate in a Farm to School presentation by Carrie Tollefson.*
- **PERFORMANCE MEASURE:** *We will count the number of students present during classroom visits and larger school presentations given by Carrie Tollefson. We will track the number of schools who request the posters and the total number of posters distributed.*
- **BENCHMARK:** *During 2010-11 Carrie made presentations to approximately 1,000 elementary students in Wadena, Hopkins and Holdingford. The benchmark for the number of posters is zero.*
- **TARGET:** *Our goal is to have no less than 5,000 students see Carrie's presentation in person during the grant period. We also intend to distribute no less than 800 posters to schools.*
- **Actual:** *We printed 500 posters – including 250 of a significantly larger size (18" x 24") in addition to the normal size 11" x 17". We distributed the posters to school food service professionals at the MN School Nutrition Association annual conference each year and have it available on the Minnesota Grown website along with our other marketing materials. Carrie's presentation reached approximately 1,400 students in person. She visited Lac Qui Parle Middle and High School in Madison MN, Loring Elementary in Minneapolis, Meadowbrook Elementary in Hopkins, Morris Public Schools elementary, and the community F2S event serving all of Minneapolis Public Schools.*

26. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.
- *See #9 above for benchmarks, targets and actual outcomes.*

BENEFICIARIES

27. Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.
- *Approximately 1,000 specialty crop growers were members of the Minnesota Grown Program during the course of this project. This includes Christmas tree growers, nurseries, garden centers, apple growers, berry growers, farmers market vendors, and grape growers.*
 - *New farmers are an important segment of our members. The Minnesota Grown Program adds an average of 80 new members each year. Many are beginning farmers eager to capitalize on the existence of a comprehensive, affordable, effective statewide marketing program such as Minnesota Grown. The Specialty Crop Block Grant Program is a tremendous benefit to the statewide efforts of this program, providing funds to implement activities that the MDA's program budget is unable to afford.*
 - *This project benefited socially disadvantaged farmers, particularly Hmong growers who rely heavily on farmers markets to distribute their produce.*
28. Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.
- a. The MDA has surveyed of Minnesota specialty crop growers who are listed in the Minnesota Grown Directory. The results provide clear evidence of the fact that consumers who use the Directory to facilitate their purchases of specialty crops. Over 95% of specialty crop growers who responded to the survey report that the Minnesota Grown Directory has influenced at least a percentage of their sales. In fact, 12% of participating specialty crop growers reported that the Directory is responsible at least 25% of their direct to consumer sales.*
 - b. Further evidence of how this Directory increases the competitiveness of specialty crops by generating actual sales of specialty crops can be found in results of the MDA's 2012-13 surveys of customers of berry farms, apple orchards and Christmas tree farms. This in-depth consumer research was funded in part by*

USDA's Federal-State Marketing Improvement Program (FSMIP). Of the nearly 500 apple orchard customers who participated in the survey, 6% reported using the online Minnesota Grown Directory to find and gather information about the orchard. These customers report an average purchase of \$38.75 per visit to the orchard. For the more than 700 participating customers at pick-your-own berry farms, 20% used the Directory (on-line or print) to gather information about the farm they chose. Their average purchase price was \$31.68 per visit. For choose and cut Christmas tree farms, 10% of their customers reported that the Minnesota Grown Directory provided them with information about the farm. The average purchase price for these customers was \$73 per visit.

c. Here are the number of growers and the number of clicks for each of our major campaigns that were paid for by this project:

• Apples:	115 orchards	38,900 clicks
• Berries:	144 farms	12,014 clicks
• Christmas trees:	59 farms/lots	20,173 clicks
• Pumpkins:	140 farms	16,010 clicks
• Wine/grapes:	36 farm wineries	18,781 clicks
• Honey:	72 farms	6,559 clicks
• CSA farms:	97 farms	8,061 clicks

LESSONS LEARNED

29. 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.

- a. *Social media platforms are a legitimate marketing tool that specialty crop growers should seriously consider utilizing if there aren't already doing so. The number of visitors who came to www.minnesotagrown.com directly from a Facebook page increased from 4,736 in 2013 to nearly 8,000 in 2014. Facebook advertising (promoted posts and Facebook ads) are a cost-effective tool that growers should consider utilizing. We have found the cost per clickthrough using Facebook ads to be very similar to the cost per click of sponsored search advertising. Through this project, our promoted posts and ads related to specialty crops were seen by just over 442,000 people at a cost of just over \$5 for every 1,000 people that sees the ad.*
- b. *As expected, the way consumers access information online has changed dramatically. This impacts all businesses that serve the public, including specialty crop farmers as well as service providers like Minnesota Grown. It affects the design and content of web pages, electronic newsletters, and any other electronic communication. During the two full calendar years covered by this project, Google Analytics for www.minnesotagrown.com provides clear evidence of the shift to smart phones and tablets. In calendar year 2013, desktops accounted for 62% of our web traffic. In just one year, this dropped by 12% to 50% of all traffic. Smart phone users accounted for the vast majority of the shift, increasing from 26% of traffic in 2013 to 36% in 2014. Tablet accounted for the balance of traffic, increasing slightly from 12% of traffic in 2013 to 14% in 2014.*
- c. *Collaborating with other organizations can be very helpful but it also has risks. We've had great partners, including the MN Fruit and Vegetable Growers Assn, MN Apple Growers Assn, MN Christmas Tree Assn, and various farmers market associations. These collaborative efforts have been key to our overall success. But when a collaborating organization changes its mission or ceases to exist the way The Minnesota Project did during this project, it can cause delays and some degree of frustration.*

30. Provide unexpected outcomes or results that were an effect of implementing this project.

Developing a relationship with the Hmong American Farmers Association (HAFA) turned out to be an even better strategic connection than the original partnership with The Minnesota Project. The Hmong American Farmers Association (HAFA) is a nonprofit organization that was created in 2011 to

serve, support and advocate for Hmong American farmers and their families. The organization's mission is to advance the prosperity of Hmong American farmers and their families through economic development, capacity building, advocacy and research. More specifically, HAFA uses an organizing approach to work with its farmers and others in the small, minority farming community to access resources so that they can expand and improve their farming operations, and thereby provide the Twin Cities' metropolitan community with fresh, locally grown, healthy fruits and vegetables. HAFA is the only organization in Minnesota that was started by and is led by Hmong American farmers and it is the only one singularly focused on the advancement of Hmong American farmers and their families.

31. If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

At the beginning of the project, our partner for this portion of the project was The Minnesota Project, a well-known non-profit organization that had assisted us in a previous SCBG funded project related to SE Asian vegetables. When they closed their doors, the SE Asian vegetable card portion of the project was significantly delayed. This is one of the risks inherent when working with non-profit organizations.

ADDITIONAL INFORMATION

32. Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.

The Minnesota Grown website is viewable at www.minnesotagrown.com

Here's a video promoting the Apple Crunch to all elementary school age students in the Minneapolis Public Schools: http://nutritionservices.mpls.k12.mn.us/great_lakes_apple_crunch.html

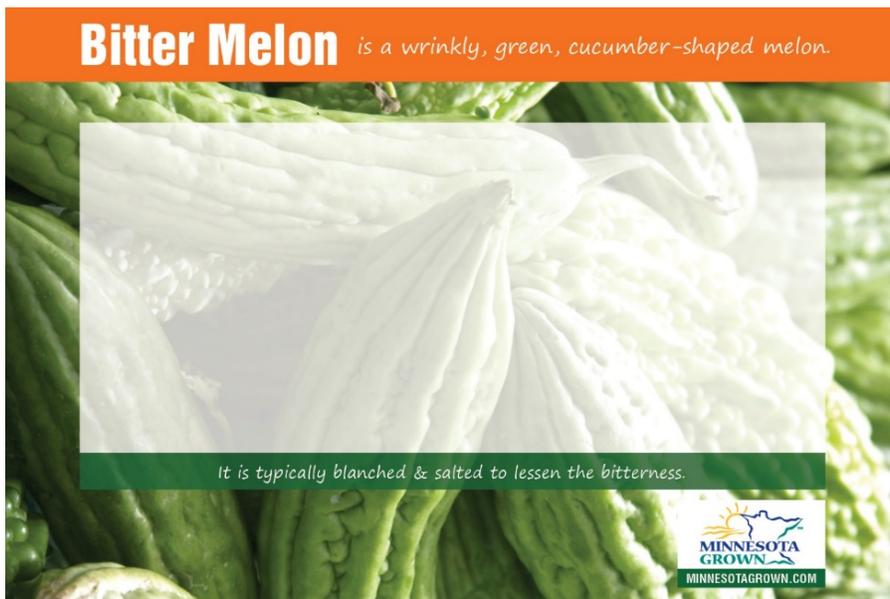


Figure 1 Example of SE Asian Vegetable Pricing Card. Actual Size: 4"x6"

Project 4 (Previously Submitted, Included for Reference)

FINAL REPORT

PROJECT TITLE

Farm to Child Care: Opening New Markets for Minnesota Specialty Crop Producers

Contact Name: Karen Quiroz

Telephone: 612-870-3478

Email: kquiroz@itap.org

Date Submitted: March 21, 2014

Revised: February 20, 2015

PROJECT SUMMARY

1. *Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.*
2. *Establish the motivation for this project by presenting the importance and timeliness of the project.*
3. *If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.*

The **initial purpose** of Farm to Childcare was to develop a new market for Minnesota's specialty crop growers. This project was **timely** as it allowed us to build on the momentum of the successful Farm to Childcare pilot with New Horizon Academy (NHA) from the previous year. This project was **important** because the full implementation of the pilot increased purchasing from Minnesota specialty crops farmers and demonstrated that purchasing locally grown specialty crops is a viable and sustainable option for a large-scale company, such as NHA. This **project built on a previous grant from the Specialty Crops Block Grant program** (December 2010 – December 2012), which supported research on Farm to Childcare models nationwide and the pilot with NHA. What we learned from the research and pilot experience shaped our activities. For example, in our research we found that most of the Farm to Childcare models focused on gardening activities, not by developing a supply chain for local farmers. This is in part because larger childcare centers already work with caterers or suppliers who handle both food sourcing and preparation (or processing). Thus, in our project, we knew to start by building relationships between farmers and NHA's suppliers and to highlight the successes and challenges of this process in our outreach materials.

PROJECT APPROACH

4. *Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.*

We are pleased to report that with support from the Specialty Crop Block Grant Program and our partner New Horizon Academy (NHA), we successfully launched our Farm to Childcare model at 62 childcare centers throughout Minnesota. The project reached more than 7,000 children throughout Minnesota, resulting in more than \$57,000 in specialty crop sales by Minnesota farmers. We are especially proud of the curriculum, parent outreach resources and complementary "Lessons Learned" description of our project. (See attachments.) Though federal budget cuts prohibited implementation of a pilot, we did collaborate with the Minnesota Head Start Association (MHSA) on planning for a Farm to Head Start model. Thus, we have achieved our goal of opening up a new institutional market for Minnesota specialty crop growers.

Grant funds were used only for the procurement of the following ten specialty crops: zucchini, peppers, pea pods, tomatoes, cucumbers, cabbage, carrots, winter squash, apples and melons. Financial controls in place to ensure proper use of funds include: (1) IATP accounts for government grants separately from private funds. (2) We track staff hours related specifically to the project budget from our Specialty Crops Block Grant contract.

GOALS AND OUTCOMES ACHIEVED

5. *Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.*
6. *If outcome measures were long term, summarize the progress that has been made towards achievement.*
7. *Provide a comparison of actual accomplishments with the goals established for the reporting period.*
8. *Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.*

Activities included:

- *Rolled out the Farm to Childcare initiative at 62 NHA childcare sites, statewide, reaching more than 7,000 children in 2013. We adapted the materials from the pilot into a “train the trainer” workshop for center directors which we co-conducted with NHA leadership. All of the 62 center directors were divided into five groups for their training, with at least one director who had participated in the 2012 pilot participating in each group to share their experiences and answer questions. The center directors then provided workshops for their teachers and kitchen staff. These experienced directors were identified as in-house “experts” available on an ongoing bases to assist others just starting the program. Each month, we conducted check-in calls with NHA to provide ongoing assistance and support. While it was a significant investment of time, the roll out went very smoothly, and NHA received very positive feedback from parents.*
- *Developed the Farm to Childcare Package for interested stakeholders across the state, including menuing strategies, recipes, student curriculum, parent outreach tools and evaluation protocols developed through our partnership with NHA. IATP used the extensive program feedback gathered from teachers, center directors, kitchen staff, parents and farmers to inform the content of the final curriculum and package. By combining a description of our process and lessons learned along with the curriculum and outreach tools developed with NHA, we have created a comprehensive resource for any childcare center interested in procuring locally grown foods and educating young children about specialty crops and farmers.*
- *Coordinated with Head Start programs to familiarize them with the potential benefits of Farm to Childcare. We collaborated the Minnesota Head Start Association (MHSA) on planning for a Farm to Head Start model. In the spring we conducted a joint survey of Minnesota’s 35 Head Start sites and found the majority of respondents were “interested” to “very interested” in Farm to Childcare. Through discussions with their staff, we learned that many features of the Head Start model match with what we believe to be best practices for farm to childcare, including extensive parent outreach and experiential learning activities. We also were able to use some of the feedback on complementary work gathered through the Head Start survey to expand our curriculum activities to include “Table Talk” conversations with children during mealtime that reinforce the Farm to Childcare message. In March of 2013, we presented to a group of around 40 at the annual training meeting of Minnesota Head Start’s nutritionists in St. Cloud, introducing the idea of Farm to Childcare, sharing our experiences with NHA and asking for their questions and feedback. The nutritionists were very enthusiastic and saw synergy*

with the work they were already doing. In May of 2013, we presented to a group of around 30 Head Start Health Coordinators at their annual training event in St. Cloud, and received a similar positive response. Despite staff's enthusiasm, Minnesota Head Start was not able to take on a formal Farm to Childcare program during 2013 due to federal budget cutbacks made during the sequester. However, we maintained open lines of communication with Head Start leadership throughout the year and continued to lay the groundwork for future collaboration.

- *Collaborated with the Minnesota Grown Program of the Minnesota Department of Agriculture to develop and disseminate a family oriented version of the "Minnesota Grown Directory" and farm to childcare posters.* The directory includes listings for nearly 1,000 local farms, plus games, activities and fun facts about Minnesota agriculture to help parents pique their children's interest in local agriculture. We distributed 10,000 copies of the directory and posters to our network of childcare partners, accompanied by an explanatory letter encouraging them to explore Farm to Childcare and to support local producers.

In comparing the actual accomplishments to the project with the project goals, we see that the Farm to Childcare implementation was a success, surpassing some of our original goals in terms of children reached. We are especially proud of the curriculum and parent outreach resources and complementary "Lessons Learned" description of our project. Together, these resources are a comprehensive reference for any childcare center that is interested in starting or expanding procurement of locally grown specialty crops. The world of Farm to Childcare is a ways behind Farm to School in terms of having descriptions of successful models to replicate and ready-made resources to use. This resource removes the burden of program planning, curriculum development and parent outreach resource design. With this baseline work in hand, enthusiastic childcare providers will be able jump right in to a Farm to Childcare model they know works and to innovate on their own. We are very excited that NHA has had such success with the model we developed with them, but we are even more excited to have created lasting resources for other centers, that we believe will lead to increased sales of locally grown specialty crops in future.

While overall we were pleased with the work with Head Start, because of budget cuts caused by the federal budget sequestration in 2013, Head Start was not able to undertake any new initiatives. Instead of implementing a pilot, we developed a proposal for a pilot project that includes working with a local Hmong growers association.

Evaluation Table for Farm to Childcare - Please see evaluation table attached documenting projected targets and results from quantitative evaluation.

Goal: Increase sales of locally grown specialty crops to targeted facilities
Measure: MN Specialty Crops purchased by childcare centers across the state.

Benchmarks from pilot (June- November 2012)	Targets for implementation	Results
\$8,500 in purchases in 2012	(June – December 2013) \$62,000 in purchases	\$57,723 or 93% of sales target
8 varieties purchased in 2012	8 - ten varieties	Ten varieties or 100% of variety target, includes: Apples, carrots, cabbages, melons (cantaloupe), cucumbers, peppers, squash, snap peas, tomatoes, zuchinis

Goal: Minnesota children eat a variety of specialty Crops
Measure: Number of participating children and servings of specialty crops

Benchmark from Pilot (June- November 2012)	Targets (June – December 2013)	Results
1,350 children served in 2012	7,000 children served (55 sites)	7,890 children served (62 sites) or 112% of target
Servings not estimated	210,000 servings	230,500 servings or 109 % of target

BENEFICIARIES

9. *Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.*
10. *Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.*

Key beneficiaries:

- Minnesota specialty crop growers who increased their sales to a market previously untapped with room for future growth.
- Children at NHA childcare centers who received increased servings of locally grown specialty crops and education about specialty crop nutrition and farming.
- NHA childcare centers who have:
 - o A complete model for Farm to Childcare that include procurement, menuing, classroom curriculum, staff training and parent outreach.
 - o Expanded their staff's competency to work with fresh, locally sourced specialty crops and to educate young children about specialty crops and specialty crop farmers.
 - o Increased the amount of fresh, specialty crops served to children
 - o Minnesota Head Start Association leadership has an increased understanding of locally grown specialty crops, how they can be sourced and how Farm to Childcare can enhance the Head Start experiential learning model.

Quantitative Benefits: Our more detailed evaluation with NHA provides some promising quantitative descriptions of Farm to Childcare's impact on participants:

- Five specialty crop growers benefited from an additional \$57,723 in sales and access to a new market.
- 7,890 children were served these specialty crops and received education about these foods, how they are grown and the local farmers who grow them.

LESSONS LEARNED

11. *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.*
12. *Provide unexpected outcomes or results that were an effect of implementing this project.*
13. *If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.*

While the attached lessons learned package goes into great detail on this issue, the following are a few key insights:

- When expanding the Farm to Childcare program to all of NHA's centers, it was very effective to use their existing training structures to introduce the broader group of

teaching and kitchen staff to the new project. In NHA's case, they are familiar with the "train the trainer" format of training center directors first, and then having them train their own center staff. Working to align our program structure with existing systems minimized confusion for NHA's staff and created less additional work in implementation. Most important, it ensures that center directors learn how to implement the program and to take ownership of it themselves.

- Similarly, when planning NHA's local food procurement, it was effective to find a way to fit that procurement into the food distribution structure they already had established with their prime distributor. Because we worked within their existing system, it was scalable, and much easier to expand the program to all of their centers.
- The Farm to Childcare movement is still in its early phase, leaving plenty of room for growth. As we have presented on our model to networks of childcare providers locally and nationally, we have consistently found enthusiasm and many questions on how to get started. Creating ready-made resources like our curriculum package will offer childcare centers an easy way to get started. Because this project was developed and implemented with public support, we were able to transparent about challenges and success and develop valuable resources to be made available without charge to childcare providers across the state and country.

There were no **unexpected effects of this project** and **goals and outcome measures were achieved**. While we reached only 93% of the target goal for sales, this does not reflect any particular barriers in sales. We believe 7% is within a reasonable margin of error for projections given the many variables in specialty crop production and procurement.

Project 5 (Previously Submitted, Included for Reference)

MN Specialty Crop Block Grant FINAL PERFORMANCE REPORT

Submitted by: Steve Poppe

e-mail: poppesr@morris.umn.edu

Phone: 320-589-1711

Date: 12/29/14

PROJECT TITLE

1. Provide the project's title.
Producing Strawberries Throughout the Growing Season With a Small Environmental Footprint

PROJECT SUMMARY

2. Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

Availability of locally grown strawberries is extremely limited in the Upper Midwest, primarily due to the short growing season. Fruit is an important part of a healthy diet, and while there is an expressed interest in having greater access to locally grown strawberries, lack of suitable varieties and production systems has prohibited growers from being able to fulfill this need in our region.

For the last two years, our main objective was to conduct day-neutral strawberry trials using a low tunnel organic production system. To make fresh, locally grown strawberries available for an extended season, we established six day-neutral strawberry cultivars in raised beds using plasticulture with and without tunnels. We harvested day-neutral strawberry fruit from mid-July through mid-October 2013/2014 at the West Central Research and Outreach Center (WCROC) Morris site, the University of Minnesota St Paul campus site, and two farmer-cooperator sites.

A second objective was to work with current and potential growers to educate them on these new strawberry production methods. The third objective was to evaluate our success at increasing strawberry production in the Upper Midwest through collaboration with partner organizations. These organizations included U of M faculty and staff, student workers, grower cooperators, volunteers, existing and new grower audiences, commercial food suppliers, and Farmers Markets.

3. Establish the motivation for this project by presenting the importance and timeliness of the project.

Strawberries are a healthy addition to any diet. However, Minnesotans have limited access to fresh, locally grown fruit, largely because of the short growing season. Market farmers growing strawberries are limited to a very short harvest season, because the most successful varieties for field production in our region are June-bearing types. Newer day-neutral strawberry varieties, coupled with novel production methods, may offer growers the option of a longer harvest season using environmentally responsible methods.

Our research is both important and timely. The USDA now recommends that consumers fill half their plate with fruits and vegetables, illustrating the importance of these foods as part of a healthy diet (USDA, 2011). Consumers are responding with increased interest in fresh, local fruits and vegetables (Frith, 2007). Several local food organizations and numerous

individuals surveyed in the Morris Healthy Eating Community Food Assessment (2010) have expressed interest in having greater access to fresh, local fruit for a longer season. Sodexo, food distributor for University of Minnesota-Morris (UMM), commented that they also would like to buy locally grown fresh fruit. In the same vein, growers in Minnesota and beyond are seeking ways to increase profits, improve sustainability and maintain the viability of farming as a profession.

Day-neutral strawberry varieties produce flowers and fruit continuously when temperatures are optimal for plant growth. Older varieties have performed poorly (low yield and fruit quality) in our region, as concluded by research at the U of M (Luby, et al. 1987; Luby, 1989). However, with newly released varieties and newer technologies, fruit quality may be higher. Recent USDA research on day-neutral strawberry varieties grown under low tunnels has resulted in increased yields of high quality fruit when compared to open-field-grown plants, with reduced incidence of bacterial and fungal diseases, fewer weeds, and reduced water use (Lewers, 2012).

4. If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

Our SCBGP was funded for 2013-2014 and was not previously funded in an earlier year.

PROJECT APPROACH

5. Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

**St Paul Site 2013-2014
Low Tunnel Treatment**

Cultivar	Average yield per plant (lb)	Average yield per acre (lb)	Average weight per berry (g)
Monterey	1.07	18941	13.27
Evie-2	1.16	20523	12.77
Albion	0.96	16949	13.19
Portola	1.01	17824	13.39
San Andreas	0.86	15105	13.82
Seascape	0.77	13378	11.41

**St Paul Site 2013-2014
Non-low Tunnel Treatment**

Cultivar	Average yield per plant (lb)	Average yield per acre (lb)	Average weight per berry (g)
Monterey	0.89	15558	12.72
Evie-2	1.1	19327	11.93
Albion	0.75	13295	12.22
Portola	1.0	17577	13.38
San Andreas	0.75	13232	13.82
Seascape	0.68	11806	10.42

**Morris Site 2013-2014
Low Tunnel Treatment**

Cultivar	Average yield per plant (lb)	Average yield per acre (lb)	Average weight per berry (g)
Monterey	1.16	21071	15.84
Evie-2	1.16	21121	15.98
Albion	1.05	19026	16.71
Portola	1.63	29634	19.26
San Andreas	0.99	18120	16.80
Seascape	1.19	21731	14.11

Morris Site 2013-2014

Non-low Tunnel Treatment

Cultivar	Average yield per plant (lb)	Average yield per acre (lb)	Average weight per berry (g)
Monterey	0.84	15319	15.21
Evie-2	1.07	19516	14.62
Albion	0.88	16055	15.94
Portola	1.23	22357	16.31
San Andreas	0.79	14315	16.57
Seascape	0.88	16003	12.66

Traditional June-bearing strawberry varieties in Minnesota have a baseline yield of 5,500 pounds/A. Preliminary data from USDA low tunnel trials calculated yield for day-neutral varieties varying between 8,600 pounds/A to 19,000 pound/A (Lewers, 2012). Average 2013-2014 yield under low tunnels was 17,120 pounds/A at the St. Paul site and 21,784 pounds/A at the WCROC site; both within the USDA benchmark and exceeding June-bearing strawberry varieties in Minnesota. As a comparison, average 2013-2014 yield in the non-low tunnel treatment was 15,133 pounds/A at the St. Paul site and 17,260 pounds/A at the WCROC site; again within the USDA benchmark and exceeding June-bearing strawberry varieties in Minnesota.

As part of our original proposal we did a 2013 comparison yield trial with 'Tribute', an older day-neutral variety. The six comparison strawberry varieties were Monterey, Evie-2, Albion, Portola, San andreas and Seascape. 'Tribute' grown in a low tunnel was comparable in yield, 20,524 pounds/A and comparable in pounds/plant at 1.13 pounds. The individual berry weight was extremely small at 6.62(g) average berry weight. The berry weight for the six day-neutral cultivars we trialed averaged 16.45g at WCROC and 12.98g at St. Paul, which is a considerably larger fruit size. The cultivars we trialed with newer technologies have proven to be superior over older varieties.

We also calculated the average number of lbs. per plant over the duration of the 2013-2014 harvest season. The range of commercially acceptable lbs./plant for June-bearing cultivars is 1 to 1 ½ lbs. per season. The six day-neutral cultivars grown under low tunnels averaged 1.19 lbs. per plant at WCROC and 0.97 lbs. per plant at St. Paul, while the non-low tunnel averaged 0.95 lbs. per plant at WCROC and 0.86 lbs. per plant at St. Paul.

In order to determine individual size of fruit (g) of each cultivar, we randomly chose 20 berries per treatment at each harvest in 2013 and

2014. At WCROC, the average berry weight (g) across six cultivars for both years under the low tunnel was 16.45g, while the non-low tunnel averaged 15.22g. At St. Paul, the average berry weight (g) across six cultivars for both years under the low tunnel was 12.98g, while the non-low tunnel averaged 12.42g. By comparison, 2010-2011 data from the WCROC June-bearing variety trial shows the average berry weight was 11.45g per individual fruit. After two years of research, the six day-neutral cultivars are proving to have larger individual fruit size when compared to June-bearing strawberry trials in Minnesota.

Hourly temperature and relative humidity were recorded at the Morris site in 2013-2014 using WatchDog A-Series data loggers in the low tunnel and non-low tunnel beds. The data loggers were suspended 12 inches above both beds. Observations from data loggers showed temperatures in the low tunnel were normally higher during the heat of the day, as compared to non-low tunnel temperatures. The 2013 low tunnel average temperature was 3.1 F above the non-low tunnel bed. The 2014 low tunnel average temperature was 1.0 F above the non-low tunnel bed. This temperature data shows overall the temperatures averaged out to be very similar in both low tunnel and non-low tunnel treatments

Temperature and relative humidity at WCROC, Morris

	Low tunnel-2013	Low tunnel-2014	Non-low tunnel-2013	Non-low tunnel-2014
Average temperature	71.3 F	64.6 F	68.2 F	63.6 F
Average relative humidity	82.4%	78.2%	74.1%	70.7 F
Average dew point	63.5	56.4%	57.8	51.8 F

During the 2013 late summer/fall picking season at the WCROC site, we tasted a noticeably sweet strawberry. We randomly took brix/sugar levels during the picking season of all six cultivars in the low tunnel and non-low tunnel treatments. The results showed an average brix level of 7.6 between late July and early October in both low and non-low tunnel treatments. To compare these brix levels, we also randomly took readings in our 2013 WCROC June bearing variety trial between late June and early July; the results showed an average brix level of 7.7. This comparison shows that day-neutral cultivars are just as sweet as June-bearing cultivars commonly grown in Minnesota.

6. Present the significant contributions and role of project partners in the project.

Principal investigator, Steve Poppe, was the overall manager of the project with specific duties of project planning, planting at four sites, coordinating duties, and data collection at the WCROC site. Co-investigator, Emily Hoover, assisted with project management, project evaluation, project administration, and experimental design. U of M graduate student Andy Petran coordinated efforts at the St. Paul site and overall statistical analysis of data. His Ph.D. research involves investigating the viability of day-neutral strawberry cultivars and cultural practices for production in the Midwest. Emily Tepe and Esther Jordan oversaw communications and outreach primarily through maintaining the research section of the website and fruit blog <http://fruit.cfans.umn.edu/>. Mary Jo and Luverne Forbord, Owner/Operator Prairie Horizon Farm, Starbuck, MN, and Craig and Paula Feuchtenberger, farmers, Morris, MN, were our farmer-cooperators. They assisted with planting, cultural practices, harvest, and served as consultants throughout the project.

As we've continued to make modifications and adaptations to this production system during 2013-2014, we've relied on assistance from several volunteers, farmer-cooperators, student interns and other U of M staff. These people played a very important role in this project. Since they have partnered with us on this project, we asked for their impressions and feedback on the project. Below are their remarks.

- The customers that are purchasing these strawberries are amazed at the quality and taste of these strawberries.
- I have thoroughly enjoyed hearing responses to seeing and tasting fresh strawberries, in Minnesota, during the months of August through October. I usually hear "where did you get these?!" and "where can I buy them?" My own two children, in fact, will no longer eat store-bought strawberries, because they've tasted the strawberries I've brought home from the WCROC after harvest.
- Our volunteers that help us harvest are asked where they were able to get their hands on fresh strawberries in late summer/early fall. Needless-to-say, there is a buzz around the Morris community about our project and the potential it holds for bringing strawberries to consumers when fresh and local strawberries are typically difficult to find.

- The strawberry plants seem to be bigger and healthier under the low tunnels compared to the non-low tunnel plants
- I think more growers could adopt this system if it wasn't so labor intensive in setting up and taking down the low tunnels each year and generating a lot of wasted plastic.

GOALS AND OUTCOMES ACHIEVED

7. Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.

Activities that were completed to achieve performance goals and measurable outcomes:

- Research faculty ,staff, PhD student, undergraduate students and student interns conducted field trials and collected data.
- Partner organization support through Sodexo Food Service, UMM purchasing strawberries from our trials during a non-traditional time. With our assistance in providing strawberries, UMM student's consumption of fruits and vegetables is increasing. In 2013, 18% of students reported eating five or more servings of fruits and vegetables, a 20% increase over 2010. (Healthy Eating Minnesota Initiative 2009-2013 Final Report).
- Farmer-cooperators use of time and land to conduct farm trials. They shared their experience and sold their strawberries through Farmers Markets thus communicating with existing and new consumers.
- Develop project web page at <http://fruit.cfans.umn.edu/>.
- Communicate with existing and new grower audiences. Our research team has presented the low tunnel system to approximately 500 participants during past educational events. Ongoing communication efforts continue through websites, blogs, newsletters, educational conferences, and farmer collaborators sharing with others, all with the purpose to educate current and potential growers about these new strawberry production methods.
- Extend strawberry harvest season. With the low tunnel day-neutral strawberry system we were able to extend the strawberry season into October.
- Increase strawberry yield per acre. As stated in section #5 we exceeded Minnesota June-bearing strawberry yields, and yields were within the USDA benchmark.
- Increase number of strawberry growers in MN from 247 to 300. Although we don't have any data to confirm this, if our project is

successful the low tunnel day-neutral strawberry system may help increase the number of strawberry growers not only in the Upper Midwest but also in other geographic locations. It may also shift harvest season, therefore increasing availability of locally grown strawberries for consumers while increasing economic return to growers.

Conduct participant surveys at grower meetings to measure increased knowledge and willingness to consider changing. Conduct online surveys at project website to assess knowledge retention after conferences

Information about the low tunnel system was presented at multiple events to approximately 500 farmers and 10 extension agents. Approximately 70 farmers and 2 extension agents participated in in-person survey interviews to evaluate the effectiveness of education that was offered on the low tunnel system of producing strawberries. These interviews assessed the amount of knowledge participants gained from informational sessions and published materials, and allowed them to provide feedback on what information is still needed in order to encourage adoption of the system.

Among farmer participants, 100% confirmed that they gained some new knowledge about this alternative method of strawberry production. Over 50% of participants claimed that with the knowledge they had gained they would think critically about their current practices and consider the possibility of change. They expressed interest in establishing a low tunnel strawberry planting, especially because the system facilitates organic production.

While only two extension educators participated in our survey interviews, we believe their responses are representative of other regional extension educators. The two participating educators were from Wisconsin and North Dakota. They viewed the information from the perspective of wanting to increase strawberry production in their states. They expressed confidence that they could share information they had gained from our educational sessions with their stakeholders, who would in turn be able to implement this system.

Survey participants offered feedback on the educational sessions, highlighting areas where they would need more information before confidently implementing a low tunnel system. The area of greatest

concern was the construction of the tunnels. Armed with this feedback, we further documented the construction process with detailed photographs and videos, which are presented on our corresponding website and in other published educational materials. As research progresses, we continue to refine the system and simplify the tunnel construction where possible.

The farmer's market surveys were conducted casually, and included not only farmer's market customers but project volunteers, interns, student consumers, and non-project University of Minnesota staff. These oral surveys, which engaged approximately 50 people, were aimed at getting a snapshot of how consumers think about locally grown strawberries and how they might react to availability of locally grown strawberries between August and October, which is outside of the traditional local strawberry season. Nearly 100% of participants indicated that finding fresh, locally grown strawberries outside of the traditional season would be a surprise, and that they did not realize this was possible. These same participants expressed that they would likely purchase these strawberries if they were available. About 50% of those surveyed were given the opportunity to taste strawberries produced in the low tunnel system. Nearly 100% of these participants were pleased by the high quality of the berries, and expressed an interest in purchasing this fruit.

8. If outcome measures were long term, summarize the progress that has been made towards achievement.
 - Improve nutrition among consumers in the Upper Midwest. Although this outcome measure is long term we have had a small amount of success supplying strawberries to a commercial food supplier, Sodexo from UMM. As stated earlier, UMM students' consumption of fruits and vegetables is increasing. In 2013, 18% of students reported eating five or more servings of fruits and vegetables, a 20% increase over 2010. (Healthy Eating Minnesota Initiative 2009-2013 Final Report).
9. Provide a comparison of actual accomplishments with the goals established for the reporting period.

Goals

Accomplishments

<p>Conduct research in growing day-neutral strawberries with organic practices under low tunnels in Minnesota.</p>	<p>We accomplished this goal as detailed in #2.</p>
<p>Determine if the use of a low tunnel system for day-neutral strawberries will result in increased yields of high quality fruit when compared to open-field-grown plants.</p>	<p>Data shared in #5 shows increased yields of fruit in the low tunnel system.</p>
<p>We plan to study day-neutral varieties to determine suitability for the Upper Midwest.</p>	<p>In addition to the six cultivars selected and grown for this study, we wanted to know which cultivars are suitable for Minnesota. After two years of evaluation, the cultivars 'Evie-2' and 'Seascape' were not suitable for reliable yields nor quality fruit. 'Portola' had generally the highest yields and large fruit at both trial sites but had issues with leaf spot. Apparently the leaf spot did not affect yields on 'Portola'. 'Monterey', and 'San Andreas' had acceptable fruit yields. 'Albion' had average to above average yields at two trial sites in 2014. 'Albion' exhibited other favorable traits such as high brix levels, firmness and disease tolerance as compared to 'Portola', 'Monterey', 'Seascape', 'Evie2', and 'San Andreas' in 2014.</p>
<p>The overarching goal of our research has been to reduce pesticide use and reduce weeds.</p>	<p>Three of the four research sites are on organic land, so synthetic pesticides were eliminated. Alternative OMRI, (listed for use in certified organic production) products were used. With organic strawberry production there are limited options for controlling pests. We continue to learn and study</p>

	<p>other options for controlling pests so we and growers are not continually spraying approved insecticides. With the installation of white on black plastic mulch on the strawberry raised beds, weed pressure has been substantially reduced as compared to a June-bearing matted row system.</p>
<p>Work with current and potential growers to educate them on these new strawberry production methods.</p>	<p>Education is an important component of our project. Our research team has presented the system to approximately 500 participants during past educational events. Ongoing communication efforts continue through websites, blogs, newsletters, educational conferences, and farmer collaborators sharing with others, all with the purpose to educate current and potential growers about these new strawberry production methods.</p>
<p>Evaluate our success at increasing strawberry production in the Upper Midwest.</p>	<p>If growers are willing to adopt new production practices to extend the strawberry season, we will have been successful with our project.</p>

10. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.

Since this research project is new and has never been trialed in the upper Midwest, we have no baseline data. However, showing progress toward achieving set targets is shared in section #11.

BENEFICIARIES

11. Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

We were able to gain some insight on the interest of this project by using analytics from the U of M Department of Horticultural Sciences Small Fruits website, <http://fruit.cfans.umn.edu/>. As part of this site, we have created and maintained a blog detailing the objectives and processes for the day-neutral low tunnel strawberry project. With the use of Google Analytics, we are able to monitor the behavior and activity of visitors to the low tunnel strawberry blog. For the time period of August 15, 2013 through December 28, 2014, the blog received 1,980 page views. The average duration of a page view was three minutes per visit. We also know that 45% of the visitors viewed the site from Minnesota, 45% from within the United States not including Minnesota, and 10% internationally.

In addition to the increased traffic on the low tunnel strawberry blog, there has also been increased interest in the project in local media which leads us to believe that the work we are doing is of great interest to the greater community. Our project has been featured in the Morris Sun Tribune, The Fargo Forum and The Grand Forks Herald, and has also appeared in the U of M College of Food Agriculture and Natural Resources Science in the News, TWIG Bender (Department of Horticultural Science e-newsletter), MOSES (Midwest Organic and Sustainable Education Service), the Minnesota Fruit and Vegetable Growers Association newsletter, WCROC newsletter and the Nourse Farms newsletter.

At the WCROC Horticulture Night in July 2014, a special tour of our low tunnel day-neutral strawberry plots was part of the event. Horticulture Night attracts approximately 1,200 people. St. Paul graduate student Andy Petran gave the tour which included a presentation of the U of M day-neutral strawberry research project as well as low tunnel construction techniques and growing tips for day-neutral strawberry cultivars in the Upper Midwest. Andy's PhD research involves investigating the viability of day-neutral strawberry cultivars and cultural practices for production in the Midwest.

As part of another project, this day-neutral strawberry system was highlighted in an interactive guide to growing and selling strawberries in cold climates. This free guide is entitled *Cold Climate Strawberry Farming*, and is an interactive e-book from the U of M. The e-book goes into detail on important topics such as choosing your market, innovative marketing techniques, comprehensive cultivar recommendations, insurance requirements and other essential business info, and of course best practices for growing strawberries. For those already experienced with commercial strawberries, *Cold Climate Strawberry Farming* introduces a new, season-extending method of growing strawberries for cold climates

using low tunnels and day-neutral cultivars. Information about the low tunnel system was presented at multiple events to approximately 500 farmers and 10 extension agents. Approximately 70 farmers and 2 extension agents participated in in-person survey interviews to evaluate the effectiveness of education that was offered on the low tunnel system of producing strawberries. Farmer's market surveys were conducted casually, and included not only farmer's market customers but project volunteers, interns, student consumers, and non-project University of Minnesota staff. These oral surveys, which engaged approximately 50 people, were aimed at getting a snapshot of how consumers think about locally grown strawberries and how they might react to availability of locally grown strawberries between August and October, which is outside of the traditional local strawberry season. All content can be viewed online or downloaded for offline use to any iOS or Android mobile device. <http://fruit.cfans.umn.edu/category/strawberries/e-learning-tool/>

12. Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

During the 2014 growing season at the WCROC site, we kept track of all time/labor (man-hours) spent on the low tunnel and non-low tunnel day-neutral strawberry systems. When combined with yield data and average pricing, the labor data shows that the low tunnel system costs approximately \$150 more than the no-tunnel system at WCROC in 2014. It's important to consider that this loss is proportional to the size of the plot. Our low tunnel system was approximately 1/9th of an acre; if the system was 1/3rd of an acre the loss would have been \$450 compared to the no-tunnel system, and so forth. Thus, the larger a system is, the more this disparity has the potential to grow. While the low tunnels offer a buffer against environmental risks (hail protection, reduced disease incidence, possible season extension etc.), it is possible these advantages may not result in an increase in profits, especially if environmental conditions are favorable during the growing season. However, if labor data had been taken in 2013 at the WCROC site, it likely would have told the opposite story: hail storms damaged the non-low tunnel treatments and reduced yields, which would have likely made the low tunnel treatment more profitable. Other factors worth considering are the observed difference in berry quality (low tunnels appeared to yield more high-quality fruit), differences in fruit price based on location (the St Paul site consistently sold their fruit at \$8/lb), and differences in labor wages (the St Paul site also had a higher hourly wage for their workers).

Strawberry Budget-Low Tunnel Organic, (no labor)

<u>Variable costs</u>	<u>Total Low Tunnel Treatment</u>		<u>Per 100' Row</u>
Fertilizer	\$70		\$11.67
Herbicides, Insecticides, Fungicides	\$17		\$2.78
Plants	\$125/1000 (w/o shipping)	Approximately 17,500 plants/acre	\$25.00
	Total cost/acre		
Irrigation-drip tape	\$13/acre		\$2.22
Mulch-Plastic (White on Black)	\$112.00/9600' of row		\$5.00
Greenhouse Film	\$864		\$144.00
Stainless Steel Support Rods	\$348		\$58.00
Straw (for walkways)	\$56		9.33
Spring tensioners, anchors, ropes, stoppers	\$126		\$21.00
Tractor Fuel (tillage, bed preparation, plastic laying)	Approximate 1 gallon per hour	Approximate 20 hours/acre \$3.50/gallon	\$3.50
1 lb. plastic qt. containers	\$0.05	Approximate 1 lb. per plant & 200 plants per 100' row	\$10.00
Total Variable Costs			\$292.50

LESSONS LEARNED

13. 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.

One of the major challenges confronted was the lack of ability of the low tunnel plastic hoop to withstand higher than normal winds in 2013. During a severe storm in late June, we experienced 75 to 85 mph winds. At three of our four research sites, the low tunnel plastic blew off as a result of these high winds. At the Prairie Horizon Farm, Starbuck, MN they completely lost the low tunnel plastic and we were not able to recover or replace it. The other two sites were able to put back up the downed plastic with minimal damage.

In 2014 appropriate steps were taken at all trial sites to secure the plastic with new appropriate methods of reinforcement to alleviate any future damage from high winds. At the conclusion of the 2014 season we were successful with our new methods of reinforcement and had no high wind damage to the lowtunnel. This method of reinforcement is explained in full detail including construction videos on our blog.

<http://fruit.cfans.umn.edu/category/strawberries/low-tunnel-strawberry/>

In 2013 at the Freshmeister Foods site, Morris, the strawberry plants experienced extreme chlorosis. Chlorosis is a yellowing of plant leaves caused by iron deficiency. Yellow leaves indicate a lack of chlorophyll, the green pigment responsible for photosynthesis (sugar production) in plants. Any reduction in chlorophyll during the growing season can reduce plant growth and vigor. In addition, chlorotic plants often produce smaller fruits of poor quality with bitter flavor. The causes of iron chlorosis are complex and not entirely understood. As a result, we were not able to pick any fruit at this cooperative site. Even though we failed to collect any strawberry data at this site, we are learning that these new day-neutral strawberry cultivars will not tolerate high ph soils which cause iron chlorosis. Soil tests were taken at this site and the ph level was 7.9. Growers should be aware of this to avoid this issue in similar soils.

In September 2014, we noticed strawberry leaf spot, a foliar fungal disease in the non-low tunnel treatment, but not in the low tunnel. Strawberry leaf spot has a bulls-eye appearance with a gray center on the leaves. This occurred at both the St. Paul and Morris locations. 'Portola' was affected more than the other five cultivars we trialed but did not affect yield. For reasons unknown to us, the leaf spot affected only the non-low tunnel but not the low tunnel treatments.

During the August 2014 harvest period, we noticed fruit damage from western flower thrips only on the non-low tunnel treatment in Morris. This insect damage came to us as a surprise since we didn't experience this issue in 2013. Western flower thrips are slender, very small insects, and

when mature are about 0.03 inch long. Adults have feathery wings and vary in color from yellow to dark brown; nymphs are white or yellowish with small dark eyes.

Thrips feed on strawberry blossoms, which causes the stigmas and anthers to turn brown and wither prematurely, but not before fertilization has occurred. As fruit develops, thrips feeding may cause a russeting or bronzing of the fruit.

An easy way to monitor or sample for thrips is to place randomly collected flower blossoms in a zip-lock plastic bag and locate in a very warm area. After one hour, remove the blossoms and shake them onto black paper. If thrips are present, you should be able to spot the small cigar shaped insects moving on the paper.

Our method of control was applying Mycotrol, an organically approved insecticide, at 1 tablespoon per 1 gallon of water, which was applied every five days from mid to late August before we saw an improvement in fruit quality.

Two-spotted spider mite damage was detected on the leaves of day-neutral strawberry plants under the low tunnel system in late July 2014. While the damage was slight, it certainly came as a surprise since we did not experience this type of insect problem in 2013 with our low tunnel system. Typically, the two-spotted spider mite is found in very warm environments, such as a high tunnel or greenhouses.

Two-spotted spider mite damage to strawberries appears as stippling, scarring, and bronzing of the leaves and calyx. To control the mites, organic insecticide applications of Oxidate at 1 oz per 1 gallon of water was applied on a weekly basis.

The mites were detected prior to harvest; no mites were found in the non-low tunnel treatment.

This section below is meant to illustrate the positive results (earlier shared in section #5) and conclusions for the project.

Traditional June-bearing strawberry varieties in Minnesota have a baseline yield of 5,500 pounds/A. Preliminary data from USDA low tunnel trials calculated yield for day-neutral varieties varying between 8,600 pounds/A to 19,000 pound/A (Lewers, 2012). Average 2013-2014 yield data under low tunnels was 17,120 pounds/A at the St. Paul site, and 21,784 pounds/A at the WCROC site; both within the USDA benchmark and exceeding June-bearing strawberry varieties in Minnesota. In addition, at both sites we observed difference in berry quality: the low tunnels appeared to yield more high-quality fruit.

Data was calculated to determine the average number of lbs./plant over the duration of the 2013-2014 harvest season. The range of commercially acceptable lbs./plant for June-bearing cultivars is 1 to 1 ½ lbs. per season. The six day-neutral cultivars grown under low tunnels averaged 1.19 lbs./plant at WCROC and 0.97 lbs./ plant at St. Paul, while the non-low tunnel averaged 0.95 lbs./plant at WCROC and 0.86 lbs./ plant at St. Paul. The lbs./plant in the low tunnel was in or close to a commercially acceptable range at both sites.

We also calculated individual size of fruit (g) of each cultivar by randomly choosing 20 berries per treatment at each harvest in 2013 and 2014. At WCROC, the average berry weight (g) across six cultivars for both years, under the low tunnel was 16.45g while the non-low tunnel averaged 15.22g. At St. Paul, the average berry weight (g) across six cultivars for both years, under the low tunnel was 12.98g while the non-low tunnel averaged 12.42g. By comparison, 2010-2011 data from the WCROC June-bearing variety trial shows the average berry weight was 11.45g per individual fruit. After two years of research, the six day-neutral cultivars are proving to have larger individual fruit size when compared to June-bearing strawberry trials in Minnesota.

14. Provide unexpected outcomes or results that were an effect of implementing this project.

Shared in section #13.

15. If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

As stated in our original proposal, our intent was to reduce inputs in the low tunnel strawberry production system. As stated in section #12 when combined with yield data and average pricing, the labor data shows that the low tunnel system costs more than the non-low tunnel system at WCROC in 2014. While the low tunnels offer a buffer against environmental risks (hail protection, reduced disease incidence, possible season extension etc.) it is possible these advantages may not result in an increase in profits, especially if environmental conditions are favorable during the growing season. However, if labor data had been taken in 2013 at the Morris site, it likely would have told the opposite story: hail storms damaged the non-low tunnel treatments and reduced yields, which would have likely made the low tunnel treatment more profitable. Other factors worth considering are the observed difference in berry quality (low tunnels appeared to yield more high-quality fruit), differences in fruit price

based on location (the St Paul site consistently sold their fruit at \$8/lb), and differences in labor wages (the St Paul site also had a higher hourly wage for their workers).

Lessons learned are shared and available to others through our U of M Commercial Fruit website blog at <http://fruit.cfans.umn.edu/category/strawberries/low-tunnel-strawberry/>.

ADDITIONAL INFORMATION

16. Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.

The U of M Commercial Fruit blog (<http://fruit.cfans.umn.edu/category/strawberries/low-tunnel-strawberry/>) provides additional information including numerous photographs not applicable to any other prior sections.

Project 6 (Previously Submitted, Included for Reference)

Minnesota Department of Agriculture Specialty Crop Block Grant

Sponsor Award # 54791 3(5)5959

FINAL PERFORMANCE REPORT

Project Title: *GAPs for Vegetable and Fruit Growers: Cultivating a Peer Education Network in Minnesota*

Submitted by: Michele Schermann & Annalisa Hultberg

Phone Number: 612-624-7444

e-mail: scher019@umn.edu

Date: May 6, 2014

PROJECT TITLE

GAPs for Vegetable and Fruit Growers: Cultivating a Peer Education Network in Minnesota

PROJECT SUMMARY

1. Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

Recent outbreak investigations have implicated a wide range of fresh produce products as sources of foodborne illness, including pre-packaged salad and spinach, lettuce, tomatoes, cantaloupes, sprouts, berries, and jalapeño and Serrano peppers. Sources of produce contamination are varied, and contamination can occur during both the pre-harvest and post-harvest phases. Contributing factors include contact with contaminated soil, irrigation water, sewage or manure; use of contaminated water in washing or processing; and possible contact with contaminated insects. Farm workers also serve as a potential source of produce contamination. This project will improve the Good Agricultural Practices (GAPs) knowledge and food safety practices of Minnesota fruit and vegetable growers through workshops and an in-depth peer-education model. Improved GAPs are critical to maintain the competitiveness of Minnesota's specialty crop industry and protect the food supply from unintended microbial contamination.

The workshops in this next phase will be tailored to specifically address these topics. We will continue to focus on all GAPs principals and how to develop on farm food safety plans. We have added the development of a **network of Grower Peer Mentors**. Farmers have stated that they learn best from each other; hearing the practical "how-to" of food safety from their peers is an effective method of sharing information. Peer-to-peer learning has been proven to be a powerful technique for providing education and for building capacity. Therefore, we will launch and support a network of Grower Peer Mentors (peer mentors) to share information with each other, building a multiplier effect and broadening the impact of this work, and enhancing the likelihood that food safety practices are adopted on grower's farms.

2. Establish the motivation for this project by presenting the importance and timeliness of the project.

Importance – Food safety on the farm is important as more institutions are jumping on the "buy local" bandwagon. Institutional buyers like schools, hospitals, nursing homes, and prisons are serving food to populations that are more vulnerable to effects of a food borne illness (e.g. children, elderly, ill, or with compromised immune systems).

Timeliness – The Food Safety Modernization Act (FSMA) was signed into law January 4, 2011 and the Proposed Produce Safety Rules, *Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption*, have been drafted and commented on, but have not yet been finalized for release. This project helps farmers be proactive and start working on practices or making changes so they are better prepared for upcoming changes. Many of the farmers we work with are diversified small-acreage farmers and are likely to be exempt from the regulatory changes. However, food safety is good for their business and local communities and we encourage all farmers to adopt GAPs and develop a farm food safety plan. Smaller farmers may have fewer resources (e.g. staff, time, and money) and through extra knowledge from the workshops, networking, and peer advice, farmers can start to prioritize their food safety workplan actions and practices over a longer period of time, thus creating less of a burden than if they waited until the last moment.

The growing need for GAPs information by farmers cannot be met by the project team alone. Project partners such as the Regional Sustainable Development Partnerships (RSDP) and University of Minnesota (UMN) Extension have stated that over the past several years they have noticed an increase in the number and frequency of questions from farmers about GAPs and on-farm food safety.

While the GAPs team will continue to grow and remain a central resource for GAPs information in the region, there is an increasing need for others across the state who are able to provide sound food safety-related information to farmers. Many farmers who are hearing about food safety for the first time may have questions and may be more comfortable asking initial questions to other farmers who are neighbors, friends, or acquaintances.

Peer mentors can be missionaries of our messages of good food safety practices on the farm. Peer mentors educators can introduce the topic in a “safe” way and environment and we can build on that relationship for future interactions or educational offerings. .

3. If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

After delivering GAPs food safety workshops as a subcontract of a Minnesota Fruit and Vegetable Growers Association (MFVGA) SCBG project, we listened to growers and their concerns and have heard specific requests for more in-depth information regarding:

1. **Record keeping** and designing individualized, relevant, and appropriate recordkeeping systems on the farm, specifically for food safety and traceability measures.
2. Conducting a **risk assessment** and how to determine risks on the farm (e.g. related to water, soil, land, manure, workers) and the subsequent risk controls.
3. More **on-farm** and demonstration components so farmers can visualize practices and behaviors that enhance on-farm food safety.

To address these requests from the previous SCBG with MFVGA we created an interactive risk assessment exercise for host farm using their site, researched alternative recordkeeping methods and practices used by other veg growers in the region, and added the on-farm workshop model so participants could see real-life practices, good or bad, and discuss and problem-solve as a group.

We have added the development of a **network of Peer Mentors**. Growers have stated that they learn best from each other; hearing the practical “how-to” of food safety from their peers is an effective means to share information. Peer-to-peer learning has been proven to be a powerful technique for providing education and for building capacity. Therefore, we will launch and support a network of Peer Mentors to share information with each other, building a multiplier effect and broadening the impact of this work, and enhancing the likelihood that food safety practices are adopted on grower’s farms.

PROJECT APPROACH

4. Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

- a. **GAPs workshops:** All workshops were held on farms (instead of classrooms or conference rooms, where they have been held in the past), so farmers could discuss issues regarding food safety in real time, with equipment and infrastructure in front of them to facilitate conversation. Project staff visited all the farms before the workshop to do a walk-through on the farm, to discuss food safety and answer any questions they might have.

At the workshop, all participants completed a mock field risk-assessment, wrote an SOP for a food safety related task on the farm, and toured the packsheds and other facilities. The workshops did not use PowerPoint slides or other technology, as they were held in packsheds, at picnic tables or in dining rooms. The curriculum focused on the key areas of on-farm food safety including: risk assessments, irrigation and wash water safety and testing, packshed and equipment cleanliness, manure and soil amendments, recordkeeping and SOPs, traceability. We also covered the FSMA and how it may affect farmers. There was ample time for discussion among participants, which often went well after the official end time. The host farmer was asked to speak about their experiences and issues on the farm.

Participants gave the on-farm workshop model very positive reviews. Farmers were pleased to have a forum to talk with other farmers in their area about these topics, some of whom they had never met. They enjoyed discussing real-life issues, such as techniques to keep deer out of the fields, protocol for washing drains and tables, washing and sanitizing bins, testing water and record keeping. Farmers stated that they preferred the on-farm location, even if it meant taking a day out of their busy season. Qualitative evaluation comments are below:

- I liked that it brought to mind all the small things that you would not think of in a classroom
- I really liked the farm tour part, it brought up many food safety issues that I may not have thought of if we were in a classroom and I was not seeing the things first-hand
- I really liked the “applied” part of it – that I got to immediately see the application of the issues we were talking about and how other farmers addressed them on their farm.
- I attended one in the classroom and then the one on the farm and having other growers there pointing out issues that they actually had on their farm was very helpful
- I went back that same day and talked to my husband and crew about the issues. It was much more real on the farm after being at the on-farm workshop.
- I see the workshops as the starting point – I then start to learn more on my own, but the workshops, (either way), are a good starting point and intro to the material

- b. **Development of peer mentor network:** Seven farmers were trained as peer mentors via this project. Recruitment began in early spring 2013, and was targeted to partner organizations and individuals to determine farmers who would be good candidates. All potential peer mentor farmers we contacted agreed to participate. An official MOU

describing the roles of the peer mentors and the University staff was sent to the mentors, signed and returned. Peer mentors took the online GAPs class from Cornell University, which most reported was useful and interesting. They all attended (or hosted) an on-farm GAPs workshop (described above). Project staff visited the farms of each peer mentor to role-model a farm food safety walk-through and answer questions and supply resources and materials. The purpose of the visits was to understand the specific food safety issues and answer any questions they may have. For example, one farmer had a manure pile too close to the growing area, another had invested in a new brush washer and wondered how best to clean the brushes. By answering these questions we not only helped the peer mentor farmer, but we then gave them information that they are able to pass on to the farmers that they would visit. We provided peer mentors with folders with food safety factsheets, a draft “checklist” with the major food safety issues to cover, a guide to building a handwashing station and other literature, to give to the farmers they would subsequently visit.

See **appendix A** for a list of all the materials provided to peer mentor farmers in the folder to be to the farmers at the on-farm food safety visit.

By all accounts the development of the network has been successful. Farmers seem genuinely interested in being a part of a group, and liked being able to bounce questions off each other. A final project wrap up meeting was held in December to do a project evaluation and gather input for next year with the peer mentors.

- c. **Peer mentor walk-throughs:** The final activity that the mentors completed is the peer mentor walk-throughs with their other farmers. 7 mentors completed 19 walk-throughs with their neighboring farmers and friends. The mentors report that some had difficulty recruiting their neighboring farmers, and that some farmers were hesitant to have someone “criticize” their operations. We made it very clear that the mentors were not “experts”, but rather knowledgeable farmers who are conducting outreach. Any question can be sent to the project staff. We were also very clear that any results or findings would never be published with a name of a farm attached, so no one should be worried about potentially “bad” feedback on a farm’s food safety practices being spread.
- d. **Videos:** 3 food safety related videos were shot via this project. These videos are on the program’s Google+ page, YouTube channel, website, Facebook page, and the Small Farms page at the University of Minnesota extension.

5. Present the significant contributions and role of project partners in the project.

MFVGA has supported the project by providing publicity of the workshops via the printed newsletter and providing input on the location and format of the workshops. MFVGA has disseminated, through their postal mailings, of two informational documents that have been mentioned as helpful by the workshop participants.

Cindy Tong provided input and guidance on videos and other educational materials created via this project, as well as the format and content of the workshops. Other

University of Minnesota staff and faculty have reviewed materials, documents, and videos and supplied ideas for consideration.

The Sustainable Farming Association (SFA), Minnesota Food Association (MFA), Minnesota Institute for Sustainable Agriculture (MISA) also contributed to the success of this project by helping identify farmers who may be interested in participating, promoting and advertising the workshop dates, and offering suggestions for content.

The farmers who were selected to be the peer mentors are members of various organizations have embraced the importance of food safety for small farms and have carried that message forward among their peer organizations, specifically SFA. This is an unexpected positive outcome of this project and an additional layer of message delivery.

GOALS AND OUTCOMES ACHIEVED

- 6. Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.

Four on-farm workshops were held throughout the summer, one each in Henderson MN, Brainerd MN, Clearbrook, MN, and Fertile MN. See **appendix B** for a sample workshop agenda.

Three videos were created. Videos available on the UMN GAPs Education page:
<http://z.umn.edu.gct>

- 1.) Rinse-Sanitize-Rinse (How to safely clean produce with sanitizer)
- 2.) Washing a 3 Compartment Sink
- 3.) Building a Handwashing station (voiceless)

Seven farmers completed the National GAPs Program 20-hour online training.

Seven farmers made visits to a total of 19 of their neighbors to provide a neighborly on farm food safety walkthrough. They also attended (or hosted) an on-farm food safety workshop before initiating the farm walk-throughs to ensure they had a solid foundation of food safety knowledge. During the walkthrough the peer mentor conducted a visual and verbal assessment of the farm’s food safety practices. They provided a prioritized checklist of food safety practices so that there was a clear process to assess the practices of the farm vs. the best recommended practices.

- 7. If outcome measures were long term, summarize the progress that has been made towards achievement.
- 8. Provide a comparison of actual accomplishments with the goals established for the reporting period.

Project goals	Project accomplishments
GOAL 1: Hold at least 3 GAPs/food safety plan	4 GAP/food safety workshops for farmers in June 2013 (“at least 3” were proposed). We held the extra because there was particular interest in

workshops to continue to provide in-depth food safety information for fruit and vegetable growers in Minnesota. At least 60 growers will attend.	hosting another workshop in West central MN. Forty-three (43) farmers attended the workshops. Rain, cold temps and busy summer schedules may have kept numbers down. We received such positive feedback about the benefits of the on-farm model that we will continue to hold on-farm workshops next year, and work closely with other partners and farmers to actively recruit for the workshops so that we meet our target participant numbers.
GOAL 2: Develop on-farm workshop model to enhance grower learning	The project team created a flexible curriculum to be administered in the on-farm setting. Interactive portions and group learning activities which did not rely on PowerPoint were incorporated into the curriculum because the workshops were held outdoors or in packsheds. Staff visited all farms prior to the workshop date to do a walk-through with the host farmer. The model led to very good discussion and information sharing, and was very well received by participants.
GOAL 3: Provide training and a farm food safety assessment/walk-through to 8 growers to be peer mentors.	We recruited 8 farmers to be “peer mentors”, and one ended up having to withdraw; 7 peer mentors were trained via this project. All peer mentors took the online GAPs course through Cornell University, attended (or hosted) a GAPs workshop, and the majority have now finished their walk-throughs with neighboring farms.
GOAL 4: Develop 3 food safety-related short videos, related to most topical issues.	<ol style="list-style-type: none"> 1. Rinse-Sanitize-Rinse (How to safely clean produce with sanitizer) 2. Washing a 3 Compartment Sink 3. Building a Handwashing station (voiceless)
GOAL 5: Provide information and knowledge via partner’s grower meetings and dissemination of online and print resources containing food safety information and videos.	<p>GAPs information has been provided to growers at various meetings where we have handed copies of our factsheets, How to Build a Handwashing Station, and other publications.</p> <p>Project staff spoke at the annual Minnesota Farmers Market Association conference (Nov 2) to discuss food safety and the Produce Safety Rule in the Food Safety Modernization Act and how it will impact farmers. Questions from the audience related to water use and testing, food safety plans, manure use and the FSMA.</p> <p>All peer mentors, participants at the workshops, and farmers who receive a food safety “walk-through” with mentor farmers also received a set of the factsheets and other information.</p> <p>We have answered many individual email and phone call inquiries regarding this topic as well.</p> <p>We continue to field calls about how to create a food safety plans and audits. When there are questions that we are unable to answer we consult with colleagues at the University, MDA, or MDH, or the National GAPs program and we facilitate the transfer of information.</p>

9. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.

Please see below at Q11 where this response is answered in more detail. Our baseline data assumption was that none, or close to none, of the farmers attending the workshops would have a food safety plan.

BENEFICIARIES

10. Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

The primary beneficiaries are specialty crop growers in Minnesota, who now have a greater understanding of on-farm food safety and are more likely to embrace food safety practices on the farm and have food safety plans which may bring them more markets and opportunities to sell their produce.

Secondary beneficiaries include buyers like food service personnel, restaurant and wholesale distributors who buy from these growers.

Consumers like children and others populations who consume local food also benefit from food that is safer. Food produced to minimize microbial contamination decreases the public health risk of a foodborne illness outbreak.

11. Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

Forty-three people attended the on-farm workshops held in 4 locations: 9 Henderson MN, 17 in Clearbrook MN, 11 in Brainerd MN, and 6 in Fertile MN.

Major project outcomes were to have people begin implementing farm food safety practices and writing a basic food safety plan. Our baseline data assumption was that none, or close to none, of the farmers attending the workshop would have a food safety plan. Of the growers who answered this questions, two growers had plans, over half (56.8%) did not have a plan, and the remaining (37.8%) had a partial plan. When asked about the partial plan, many of the growers said they had started at one time and used the template Farm Food Safety Plan created by this team with USDA-RMA funds in previous years.

Table 1. Growers Attending Workshops with Existing Food Safety Plans.

	Frequency	Percent	Valid Percent	
Valid	No	21	48.8	56.8
	yes	2	4.7	5.4
	partial	14	32.6	37.8
	Total	37	86.0	100.0

	No answer	6	14.0	
Total	43	100.0		

After the workshop of the 35 people who said they did not have or had a partial plan, 35 of them said they would create or finish their plan. One person said no, they would not create a plan, which was not a surprise as that person was a school food service administrator and not a grower.

Table 2. Likely to Finish or Create a Food Safety Plan after attending this workshop?

	Frequency	Percent	Valid Percent	
Valid	no	1	2.3	2.7
	yes	24	55.8	64.9
	maybe	11	25.6	29.7
	have one already	1	2.3	2.7
	Total	37	86.0	100.0
	No Answer	6	14.0	
Total	43	100.0		

Finally, when asked if because of attending this workshop, were they more likely to implement GAPs practices on their farm, almost 92% of attendees said yes definitely (66.7%) or most likely (25%). Practices mentioned as soon to be implemented included handwashing/handwashing station (most frequent), writing the plan, assessing risks on their farm, sanitizing produce wash water, better recordkeeping (2nd most frequent), fencing, develop a traceability system, create Standard Operating Procedures, training workers.

Peer to Peer Visit Summary

Table 3. Peer to Peer Visit Summary

Number of farmer mentors	7
Total number of farms visited	19
Locations of farmer mentors (all MN)	Altura Brainerd Clearbrook Henderson Hutchinson Montgomery

	Wrenshall
Materials handed out by farmer mentors during walk – throughs	Prioritized GAPs Checklist for walk – through (19) Color Food Safety factsheets (76) Instructions for how to build a handwashing station (19) Food Safety employee training DVDs from Cornell University (19) Jump drives with the food safety plan templates (19) Food safety walk-through visit summary forms (completed after walk-through by mentor farmer) (19)
Most common food safety questions and issues ID'd via walk – throughs	<ul style="list-style-type: none"> ● Using manure – how long to age, how to turn, when to apply. When is manure fully composted and safe? ● Keeping birds out of packsheds ● Domestic animals (dogs) in vegetable growing areas ● Livestock (chickens mostly, also pigs, cows and ducks) in vegetable growing area including high tunnels and near packsheds ● Wildlife (deer, rabbit) in vegetable growing areas ● Developing schedules for cleaning and sanitizing harvest and packing equipment ● Livestock and other animals around wells and other water sources ● SOPs – most had few to none developed for their farm ● Using sanitizer in wash water and questions about types to use ● Sanitizers for use on hard surfaces – how often, what type ● Where to get well water tested, how often ● How to get a GAP audit, do they need one, what is involved ● When building a new packshed, what to include for GAPs

LESSONS LEARNED

12. 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.

We learned that there are potentially growers who have questions about on-farm food safety, but may be hesitant to ask a University or government employee about their questions. Therefore sharing this information from peers to peer is a very useful strategy to reach all the growers in the state.

These are some of the comments that farmer mentors made on their written food safety walk-through summaries.

- “It (the walk-through) was great – it makes a farmer look at their land in a new way.”
- “She (the farmer getting the walk-through) really was happy to have me there and for the other resources I was able to direct her to.”
- “The farmer told me as I was leaving her farm, ‘The process was really helpful and made food safety approachable.’ “
- “She seemed overwhelmed about food safety and GAPs when I got there, but after talking through it she saw it was not so hard and she was doing OK.”

- “The checklist and helping prioritize was very helpful, and helped me point him to the biggest issues on the farm. He was getting hung up on small issues and ignoring the larger ones.”
- “She was very grateful for the resources.”

Other ideas that came from the walk-throughs:

- Creating a database of commonly used SOPs that farmers could use as outlines
- Creating a checklist that was more geared toward small farmers
- Creating an online resource with hyperlinked info from the checklist, so that farmers could click for more background information on the topics they needed to read about

13. Provide unexpected outcomes or results that were an effect of implementing this project.

We were able to reach the Amish community through this project. Through a workshop that Schermann presented at four years ago, an Amish farmer contacted Schermann via letter and asked for assistance with creating a GAPs plan. Schermann was in the Northwest region of the state for other work and stopped by the Amish farm to drop off materials. A long conversation ensued which led to the idea of a workshop being held on that Amish farm for other local Amish farmers. We also connected the peer mentor farmer in that area with the Amish. The peer mentor in that area is not Amish but of another religious sect where they share similar beliefs and lifestyles so the acceptance and trust level was easily established.

Since that workshop, other Amish in that area have contacted Schermann for farm food safety equipment.

14. If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

ADDITIONAL INFORMATION

15. Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.

Appendix A

Materials in folders sent to mentor farmers to use at food safety walk-throughs.

Each mentor received 3 folders

- Intro letter explaining goals, protocol
- [Prioritized GAPs Checklist](#) for walk - through
- 4 Color Food Safety factsheets
 - [Handwashing](#)
 - [Toilets on the Farm](#)
 - [Wash Water Sanitizers](#)

[Cleaning and Sanitizing Tools](#)
[Water Testing](#)

- [Handwashing Station Instructions](#)
- [Fruits, Vegetables, and Food Safety: Health and Hygiene on the Farm](#)
English/Spanish/Hmong
- Jump drives with [the Food Safety Plan For You](#) template and other resources
- Food safety walk-through visit summary form (to be completed after walk-through by mentor farmer)

Project 7

MN Specialty Crop Block Grant FINAL PERFORMANCE REPORT

Submitted by: Vince Fritz

e-mail & phone number: vafritz@umn.edu, 218-327-4490

Date: 11/19/15

PROJECT TITLE

1. Provide the project's title.

The Minnesota High Tunnel Network

PROJECT SUMMARY

2. Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

High tunnels are simple protective structures that allow growers to extend the season and grow crops not typically hardy in Minnesota. All the ventilation is natural without electricity making them an excellent investment. Crops that are being grown in high tunnels are primarily vegetables, with tomatoes being dominant. High tunnels have been proven to be an excellent risk management tool, protecting high value, specialty crops from environmental risks such as excess rain, wind and cold. In recognizing the important role that high tunnels play in the northern tier of states, the USDA through the Natural Resource Conservation Service (NRCS) provided growers cost assistance, to purchase and construct high tunnels over the last few years. Minnesota led the nation in the number of high tunnels constructed under the USDA-NRCS High Tunnel Program in 2010/2011 with over 270 high tunnel requests being funded. In total, over 2,500 high tunnels are in production, which is expected to increase in the next few years.

3. Establish the motivation for this project by presenting the importance and timeliness of the project.

The high tunnel production of vegetables creates a unique environment that can result

in critical disease problems of the crop and rapidly become an epidemic. High tunnel crops are physically handled more than field crops as staking, tying, and pruning of plants is widely utilized to maximize space within the tunnel. Virus and bacterial plant pathogens are often introduced at very low levels on seed or infected plants (2% or less infection), under field conditions the resulting yield loss is often minimal. Both bacterial and viral pathogens, however are easily spread on workers hands and tools. In one incidence in 2011, a high tunnel grower suffered 100% infection of his tomato crop by Tobacco Mosaic Virus (TMV). This easily transmissible virus was spread on workers hands and tools while working on the crop. TMV can result in complete crop failure. Plants may fail to produce fruit if infected early or may produce unmarketable fruit displaying uneven ripening due to the viral infection.

Other pathogens identified in high tunnel tomato production in Minnesota that are uncommon in field production include white mold (*Sclerotinia sclerotiorum*), Tomato Pith Necrosis (*Pseudomonas corrugata*), and tomato spotted wilt virus. The super majority of Minnesota growers are unfamiliar with these pathogens and have trouble identifying the disease and selecting appropriate management strategies. The combination of the real threat these diseases pose to vegetable crops grown in high tunnels along with the lack of grower knowledge, put many at significant risk. Failure to address this need will undoubtedly result in more crop losses putting many other growers out of business.

4. If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

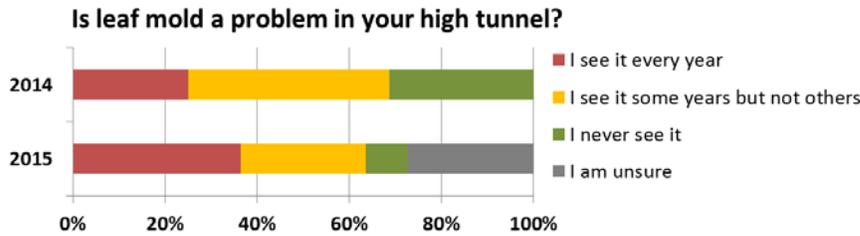
Not applicable.

PROJECT APPROACH

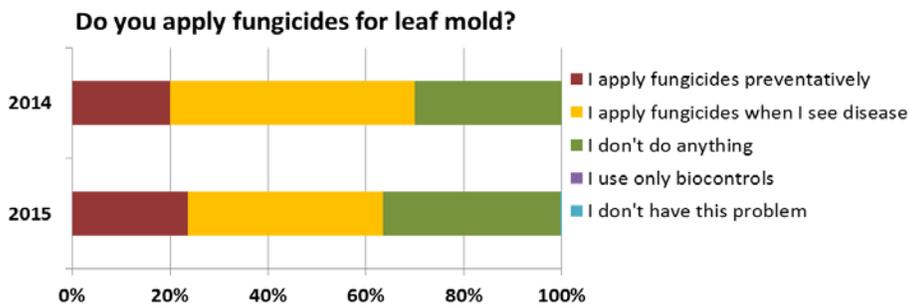
5. Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

The approach taken for completing this project was to visit 15 to 18 high tunnel operations three times each growing season in 2014 and 2015. Samples of diseased tomato, pepper or eggplant tissue were taken at each visit and samples were brought back to Dr. Orshinsky's laboratory for diagnosis via microscopy, isolation, and/or DNA sequencing methods. Viral samples were brought to the Plant Disease Clinic and analysed via Enzyme Linked Immunosorbent Assay or transmission electron microscopy. In total, over 200 plant disease samples were diagnosed each year. Results were presented annually at the Minnesota Fruit and Vegetable Association (MFVGA) annual conference in St. Cloud, MN (approximately 30 growers) and at the Minnesota High Tunnel Conference in Brainerd, MN (over 60 growers). The results have also been presented by Dr. Orshinsky to academic and Extension groups at an invited talk at Iowa State University Department of Plant Pathology (40 attendees) and at the Great Lakes Vegetable Working Group (NC-IPM working group) annual meeting (45 attendees). The results of the survey will also be presented by Michelle Grabowski in Spain at the International Symposium on Tomato Diseases: Perspectives and Future Directions in

Tomato Protection in June of 2016. The research has sparked conversation about future efforts on a multi-state level to address leaf mold, early blight, and Botrytis. The surveys were conducted at each MFVGA meetings in 2014 and 2015 using Turning Point data collection software to assess growers' perception of disease levels and impact in both years. The results are summarized in the figures below, the x-axis represents percentage of respondents. The responses in 2014 reflect the 2013 growing season, prior to visiting high tunnels. The 2015 responses reflect the 2014 growing season, which reflects grower responses after a single season of site visits and grower outreach.

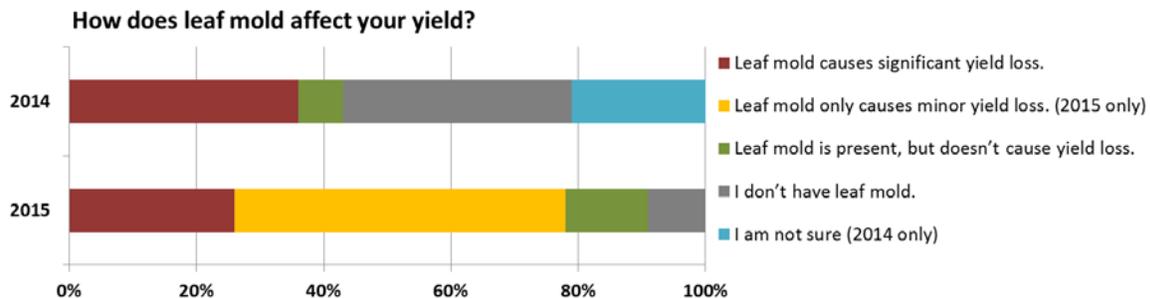


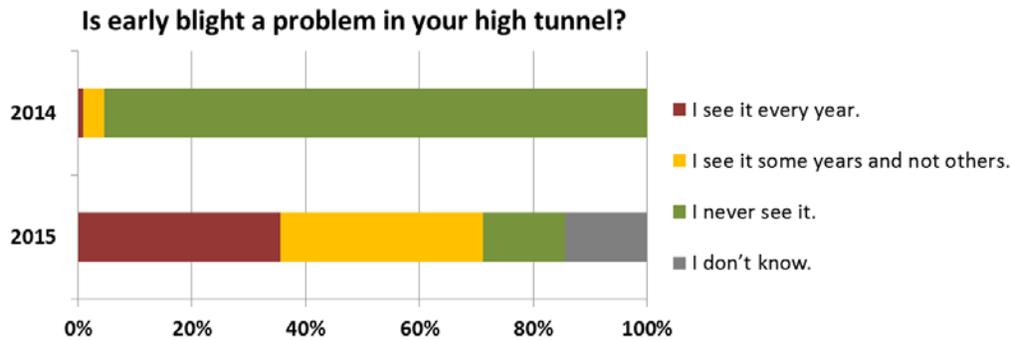
The number of respondents responding that they see leaf mold every year went up by over 10 % in 2015 over 2014. Given that we found leaf mold in nearly every high tunnel in 2014 growing season, it is more likely that the increase is due to a better ability to identify the disease rather than an increase in disease incidence.



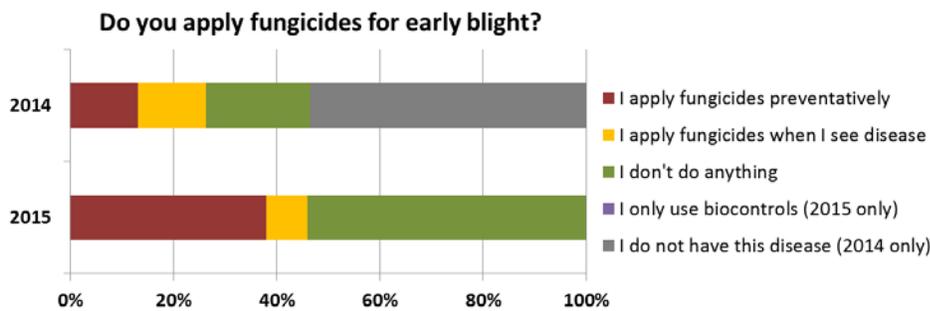
The results here suggest that there are very few changes in grower habits between the two years. This may change in the future years as we develop more recommendations for when, what, and how to treat leaf mold disease.

In 2015, almost 80 % of growers report at least some level of yield loss due to leaf mold, with 24 % of growers reporting significant yield loss.

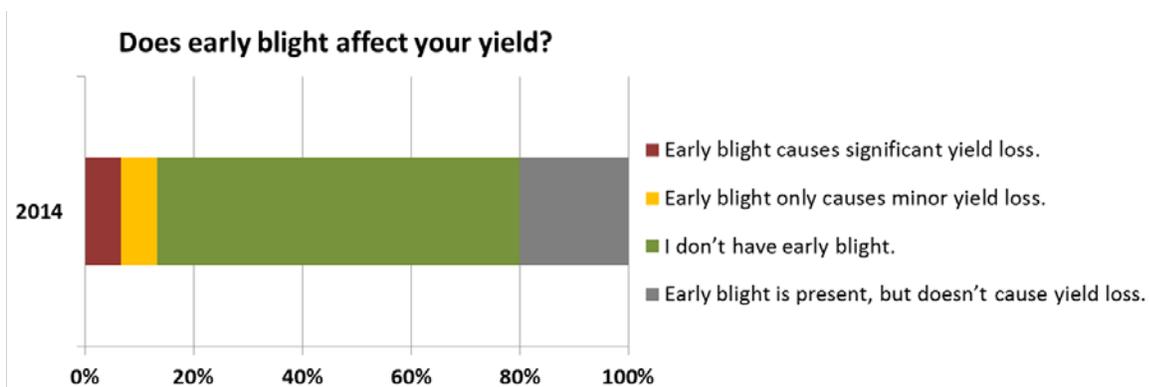




Again, given that the 2014 responses reflect grower perception prior to site visit outreach events, it is likely that the increase in growers reporting early blight in their high tunnels is more likely due to our outreach education on disease identification.

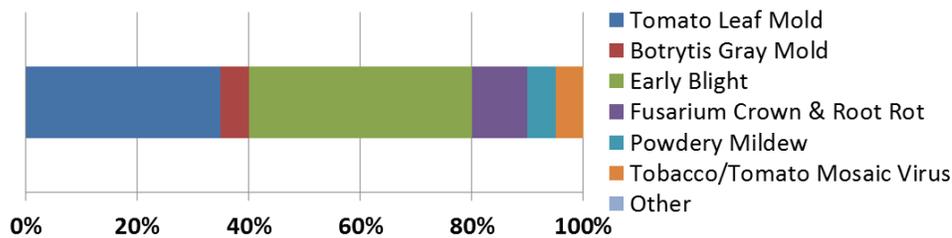


The increase in fungicide use for early blight may be related to the increased understanding of growers of what diseases are present in their high tunnels. Nearly every high tunnel had early blight in our 2014 growing season survey (2015 results).



This question was only asked in a single year. Given that we found early blight in nearly every high tunnel in the following year, it is likely that the large proportion of people responding that they do not have early blight is due to a lack of diagnostic capabilities of growers. We will be following up with this question in our 2016 survey (not part of this grant).

Which disease is most important to you?



This question was asked to gauge grower concern at the 2015 MFVGA conference. Interestingly, only 5 % of growers were interested in gray mold despite its prevalence and destruction. The 2015 growing season was particularly bad for gray mold and it will be interesting to see if the results shift this year. Many growers were concerned about early blight, but observations by Dr. Angela Orshinsky was that they were confusing concentric circles caused by gray mold fungus with those caused by early blight. The 2016 MFVGA seminar will focus on leaf mold, early blight, and gray mold to help growers work towards more accurate self-diagnosis.

The nature of this project was largely exploratory: to identify the diseases of importance to Minnesota high tunnel growers and create a baseline for disease occurrence in future years. The project was also designed to provide outreach to growers, assisting them in learning how to identify and manage these diseases.

Favorable results include completion of a high tunnel disease identification guide for MN growers, implementation of management practices by growers.

6. Present the significant contributions and role of project partners in the project.

Dr. Angela Orshinsky – Visited high tunnel operations in 2014 and 2015, diagnosed all fungal and bacterial diseases in 2014 and 2015, presented results of the high tunnel survey in 2015, wrote and edited portions of the Minnesota High Tunnel Tomato disease pocket book.

Ms. Michelle Grabowski – Coordinated the disease survey with the University of Minnesota Plant Disease Clinic and collated all data collected. Co-authored the Minnesota High Tunnel Tomato disease pocket book and presented high tunnel survey results in 2014.

Dr. Vince Fritz – Served as principal investigator and responsible for the overall project. Assisted in the recruitment of grower participation at the beginning of the project.

GOALS AND OUTCOMES ACHIEVED

6. Supply the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.

In 2014 and 2015, UMN extension staff visited 15 high tunnel farms located across the state of Minnesota at three different stages of the growing season. Over 200 samples

were collected and diagnosed each year. Results were shared directly with the growers participating in the high tunnel disease survey and as a summary with the grower community at annual conferences. These presentations included information about identification, biology and management of the specific disease problems identified in Minnesota high tunnel tomatoes and other solanaceous crops.

In addition, publications about the most common disease problems were posted on the UMN Extension webpage for commercial fruit and vegetable growers. (<http://www.extension.umn.edu/garden/fruit-vegetable/plant-diseases/index.html>). A 60 page full color booklet was created with information about all disease problems identified in the Minnesota high tunnel disease survey. The booklet included a photo identification guide, a chapter on how to scout, 14 chapters on the identification, biology and management of different disease problems identified commonly in Minnesota high tunnels, a chapter on proper use of fungicides in high tunnels, including information preventing fungicide resistance, and a list of relevant resources for growers.

7. If outcome measures were long term, summarize the progress that has been made towards achievement.

Long term goals of the project included reaching a better understanding of the disease problems high tunnel growers are facing in Minnesota. The disease survey revealed several common pathogens (*Botrytis cinerea*, *Sclerotinia sclerotiorum*) that occur at higher rates in high tunnels than previously known. In addition, less common pathogens (*Fusarium oxysporum* f.sp. *radicis-lycopersici*) were identified causing significantly greater damage than previously recorded in Minnesota. Extension staff were also able to identify disease problems (i.e. *Passalora fulva*) earlier in the growing season than previously reported by growers.

The one-to-one interaction with many growers allowed for hands-on training of growers for how to scout plants for disease, how to differentiate between important disease types, and what kinds of practices could be implemented to reduce future disease issues. Anecdotally, growers remarked on their improved skills and some have implemented new practices (submitting samples to the PDC, using fans and vents to decrease humidity, using grafted plants for soil-borne diseases, increasing spacing between plants) as a result of consultation with members of this project team.

This project also directly benefitted researchers to understand the logistical concerns regarding implementation of disease management recommendations. By observing growing operations directly, we were able to tailor recommendations to each specific grower. Our hope is that the changes in practice of this handful of growers will lead to changes in practices of growers on a wider scale.

8. Provide a comparison of actual accomplishments with the goals established for the reporting period.

Original Goal 1: Develop Solanaceous crop (tomatoes, peppers, eggplants, etc.) disease diagnostic aids and management tools for high tunnel specialty crop producers.

Actual Accomplishments: The focus of our efforts became clear early in the project that the work needed to focus on high tunnel tomato production since this was by far, where the greatest need existed. This facilitated the project coming to a successful conclusion because we were able to recruit the critical number of growers required to achieve our desired results. Fifteen high tunnel production facilities were surveyed for disease problems 3 times per year for two years in 2014 and 2015. Results were accumulated in a 60 page color booklet with information about disease identification, biology and management. This book will be distributed to all participating growers and to the high tunnel grower community at grower conferences in winter 2016.

Original Goal 2: Develop and conduct an impact survey to measure knowledge gain and new management tools used by participants.

Actual Accomplishments: Turning Point interactive software was used to survey growers about their ability to recognize and manage high tunnel disease problems at annual grower conferences before the high tunnel disease survey in 2013. Results of the 2013 turning point survey were compared with field results and presented to the growers at annual conferences in 2014 and 2015. A final survey will be sent to all growers who receive the high tunnel tomato disease booklet created as part of the project.

10. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.

Baseline data for the level of various diseases is described in the following chart. Extension and research efforts can now be invested into reducing the incidence of these diseases in MN high tunnels.

Disease	Number of Locations (out of 15)	
	2014	2015
Botrytis gray mold	4	8
Fusarium crown and root rot	4	5
Fusarium wilt	0	1
Early blight	10	14
Verticillium wilt	0	1
Leaf mold	12	10
Pythium root rot	0	1
White mold	4	3
Alternaria stem canker	4	2
Tomato spotted wilt virus	1	2
Tobacco / Tomato Mosaic Virus	1	2

Bacterial spot	2	2
Powdery mildew	7	2
Antracnose	2	2
Late blight	1	1
Septoria leaf spot	1	2
Trichothecium fruit rot	1	2
Pseudocercospora Black mold*	1	0
Late blight*	1	1

*Diseases with a star indicate diseases of importance that were identified by direct microscopy but could not be cultured.

BENEFICIARIES

11. Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

This project directly benefits the high tunnel growers of Minnesota by helping them properly identify and manage disease problems in the high tunnel. The project directly benefits all Minnesotans who benefit from fresh local produce through a longer growing season through high tunnel production. There are over 2500 high tunnels in operation in Minnesota. Tomatoes are the most profitable high tunnel crop and so a majority of high tunnel operators grow tomatoes to ensure a return on high tunnel investment. Even a 3 lb loss per plant can result in a loss of over \$3000 at a moderate market price/lb (Table 1). By reducing yield loss due to disease even a small amount through our educational efforts, we will impact the revenue of high tunnel growers throughout the state.

Table 2: The effect of yield on profit per high tunnel under a series of market values.

(Source: Karl Foord, UMN Extension Educator, based on a 2880 sq ft tunnel, 64 plants/row x 7 rows = 448 plants)

Yield		Price per lb (\$)				
lb/plant	lb/tunnel	\$1.50	\$2.00	\$2.50	\$3.00	\$3.50
7	3136	\$1,758	\$3,326	\$4,894	\$6,462	\$8,030
10	4480	\$3,347	\$5,587	\$7,827	\$10,067	\$12,307
14	6272	\$5,591	\$8,727	\$11,863	\$14,999	\$18,135
17	7616	\$7,144	\$10,952	\$14,760	\$18,568	\$22,376

12. Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

Quantitative data regarding disease incidence is outlined in Table 10. The production of a disease identification and management guide should assist growers to identify and manage disease, reducing loss of crop/harvest. However, as this was an exploratory

project, the real benefits of this project can be anticipated via future outreach efforts, increased use of the plant diagnostic clinic, increased contact with Extension educators and specialists, and future research projects that will be informed by the baseline data provided in this project.

LESSONS LEARNED

13. 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.

In the original proposal, growers were asked to submit samples for diagnosis. The project was advertised at multiple grower conferences, through grower email list serves, in grower newsletters and through person to person contact. Despite great enthusiasm for the project prior to the growing season, only 10 samples were submitted in the first year. The grant was then rewritten to allow extension staff to scout 15 tunnels three times per year to look for disease samples. Upon arriving, growers often reported few disease problems, but trained staff easily found 3 or more different disease problems per visit. In total over 200 plant samples were collected by extension staff each year in 2014 and 2015. In addition, diseases that growers often reported as occurring mid to late season were easily found in low levels early in the season by trained staff. This illustrated a lack of understanding of the growers on when and how to successfully scout the high tunnel as well as how to recognize early disease problems.

In response, extension staff took time on each site to show growers where problems were occurring and how to locate problem plants. A chapter on 'How to Scout' was included in the booklet on high tunnel tomato diseases. This chapter included scouting for the disease in seedling production, at transplant and throughout the growing season. Extension staff conducting the high tunnel survey noted a change in scouting behavior in participating growers. In year 1 of farm visits, growers were often unaware of disease problems currently beginning in their high tunnels. By year 2 many growers were flagging plants they suspected of having a problem in anticipation of the Extension visit. This behavior change shows an increased understanding and recognition of early disease symptomology and the importance of scouting. It shows that growers are beginning to take on scouting responsibilities themselves.

14. Provide unexpected outcomes or results that were an effect of implementing this project.

The project resulted in many new connections being made between UMN Extension, the UMN Plant Disease Clinic and the high tunnel growers of Minnesota. This was a very valuable outcome as UMN had a new Extension specialist in plant pathology of vegetable crops as well as a new director of the diagnostic clinic. In a survey before the project began, only 9% of growers reported ever having sent a sample to the UMN Plant Disease Clinic. As a result of the project, growers that had never contacted extension or the clinic before regularly brought in samples for diagnosis and asked for assistance in problem solving. Growers directly involved in the high tunnel disease survey began seeking assistance with problems on other crops on the farm. In addition,

growers directly involved with the high tunnel disease survey recommended the UMN extension and UMN Plant Disease Clinic to other growers, resulting in additional contacts with the grower community.

Two new viruses of tomato were identified during the course of the survey. Both viruses are currently unknown and unnamed. They are currently being examined in the UMN research greenhouses to determine their infection cycle and potential to cause significant damage.

15. If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

The goals of this project were achieved, however, there were specific aspects of the project that would have benefited from small changes in methodology and budgeting. The original budget of this grant was formulated assuming minimal travel and a reduced number of samples – particularly virus samples. The amount of travel conducted in this project far exceeded the predicted levels and budget because of the discovered need for us to travel to farms rather than rely on grower sample submission to the disease clinic. Furthermore, the original proposal did not provide adequate budget for the more than 200 diagnoses made per year, particularly viruses. Viral diagnoses cost \$45 per sample for ELISA strip test and \$85 per sample for TEM. There were a large number of viruses that could not be identified given the number of samples and further testing required to follow up on uncharacterized viruses. Future disease surveys would benefit from a larger travel and diagnostic budget given this experience.

ADDITIONAL INFORMATION

16. Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.

Our original assumption regarding grower sample submission was surprisingly miscalculated. This was primarily due to the lack of time during the production season. That along with untimely staff resignations required a reconfiguration and assessment of our approach. Traveling to each location to collect samples and observe symptoms in situ was in the end, resulted in a better outcome and impact, however this did put a strain on the funds allocated for travel in the budget.

Project 8 (Submitted as Final in 2013 Annual Report, Included for Reference)

Specialty Crop Block Grant Final Report - Promoting Minnesota Specialty Crops to Wholesale Markets, Institutions and Consumers

Project Summary

Many small to mid-scale specialty crop producers are interested in selling to wholesale and institutional markets: restaurants, school food service, caterers, and grocers. Diversifying into these markets can help producers grow their business and manage risk.

While producers can directly market to consumers through a number of avenues, there is a considerable need for expanded direct marketing links between farmers and food buying institutions. This project continued a series of statewide “Got Local?” farmer-buyer networking workshops that expand opportunities for small- and mid-scale specialty crop producers to direct market to wholesale and institutional food buyers.

Direct marketing has become a vital strategy for many producers seeking to maintain viable small or mid-sized specialty crop farming operations. While farmers have several established avenues for directly marketing to consumers they often find it difficult to connect with wholesale and institutional buyers who want to serve local foods. At the same time, there is an increasing demand for local foods. In 2011, there were 145 school districts participating in Farm to School in Minnesota: that represents 900 schools and 558,000 students.

This project addressed that gap by creating spaces where food service directors, institutional buyers, restaurant buyers, grocers, caterers, and food distributors can effectively and efficiently connect with specialty crop producers. The project also provided practical training to farmers and food service personnel that will increase the success of these farmer-buyer relationships. It also worked to strengthen public interest in Minnesota Grown specialty crops.

Project Approach

Farmer/Buyer Speed Networking

We partnered with the University of Minnesota Extension Center for Family Development and the Minnesota Institute for Sustainable Agriculture to deliver eight Got Local workshops throughout the state between December 2012 and April 2013, targeted at food service, wholesale, and institutional buyers. Five of the networking events were part of a Farm to Cafeteria workshop, which included farmer-buyer “speed-networking,” training for growers on post-harvest handling for wholesale markets, and sessions on building farm to institutions/wholesale relationships. Knowledge on post-harvest handling is critical for farmers to be successful in this portion of the food industry. The other three networking events were held as part of a post-harvest handling workshop, which provided producers important information about industry standards in terms of product quality and quantities for various goods, freshness and appearance, packaging, as well as information about delivery options. We also conducted seven farmer/buyer field trips to school cafeterias and local farms between May and October 2013 to build greater understanding and solidify relationships between institutional food buyers and farmers.

We were scheduled to facilitate an additional Farmer/Buyer networking event, but were unable to attend one due to severe weather (Farm to Cafeteria Workshop in Morris, MN on March 5, 2013). The breakdown of attendance is listed in the beneficiaries section of this report.

Farm to School Field Trips

We selected school “host sites” from among those we and our partners knew to be operating a successful Farm to School program, and then worked with that school to select appropriate specialty crop farms to visit. We developed a host guide for both the food service and farm host sites to help them prepare for the topics to be covered during the visit. Below is a detailed example of one of the agendas.

The agenda followed this general format:

- a tour of a school (or camp) food service facility;
- a facilitated discussion among participants on Farm to School
- a visit to a local specialty crop farm

Example Agenda:

Morning

1. Tour of school food service facility, including food prep area and equipment, cold storage, dry storage, receiving, and serving line/cafeteria.
Presenter(s) – Food service director and/or staff, local UMN extension educator(s)
Discussion points –
 - a. A-Z of how local foods (fruits and veg) make their way from the receiving area to the school lunch trays?
 - b. Brief summary of your involvement with F2S – when / how did you start?
 - c. How many farmers do you buy from?
 - d. How do you find your farmers / how do they find you?
 - e. What kinds of local items do you buy? How much?
 - f. What are some of the menu items you use local ingredients for?
 - g. What does the procurement and delivery process look like for local items?
 - h. Do farmers who sell to you need to meet any specific criteria (ie: food safety, organic, etc)?
How is food safety ensured for items coming from farms?
 - i. What local items / recipes are most well-received among students? What have you learned about student preferences along the way?
 - j. What kinds of promotional or educational activities are used when you feature Farm to School items on the menu?
2. MN Food Charter Event – facilitated group discussion focused on “food at school” – including challenges and strategies for expanding healthy food options at school.
3. Invited guests/speakers talk about their involvement with Farm to School, what is going on with F2S in the region, and what services are available

Afternoon

1. Ride bus to Farm #1 – time for unstructured networking among participants.
2. Tour Farm #1, include the following:
 - a. Introduction to the farm – a brief profile of the farm:
 - Farm name
 - Farm history
 - Who works on the farm? Are they seasonal, volunteer, or hourly?
 - What do you grow?
 - Where do you sell your farm products?
 - b. Tour – show / tell us about:
 - Crops you are growing
 - What are your favorite things to grow?
 - How do you control for pests and diseases?
 - What do you fertilize with?
 - What does your irrigation system look like?
 - How do you harvest your crops? By hand? With a machine?
 - How often do you harvest? How much?
 - Do you have / use on site coolers / storage / washing stations?
 - Tell us about your techniques for washing different veggies/fruits
 - Animals you are raising
 - Where do they live in the summer/winter?
 - What do you feed them?
 - How long are they on the farm?
 - Do you breed them or buy them young?
 - How do you sell / process them or their products?
 - Add anything else that seems important / interesting to share
 - c. Food Safety - tell us about your food safety plan
 - What is your food safety protocol? (HACCP / GAP?)
 - How do you create levels of separation between field and final product?

- Do you have a system in place to deal with pathogens from manure and/or well water?
 - Do you have liability insurance for food borne illness?
3. Bus to Farm #2 and repeat same content from farm #1
 4. Bus back to school, fill out evaluations, and disperse

The Farm to Childcare training for Southeast Minnesota was held on October 19th as the seventh field trip, and the target audience was childcare providers who are interested in incorporating more local food and food-related learning activities into their childcare programs. The format of the Farm to Childcare training was mainly classroom-style, with an hour-long field trip to the Rochester Farmers Market and some other hands-on activities including cooking demonstrations. The training agenda followed this format:

1. What is Farm to Childcare?
2. Why does Farm to Childcare matter?
3. Farmers Market Scavenger Hunt
4. How to use local foods with the Child and Adult Care Food Program
5. Strategies for getting started – where and how to buy local, how to encourage kids to try new foods, how to incorporate local food themes into all childcare activities
6. Example activity (seed identification)
7. Kid-friendly cooking demonstrations
8. Examples of successful programs/activities
9. Existing resources and curriculum

We were also scheduled to facilitate an additional field trip in August with Pipestone Public Schools in Southwest MN, but a decision to cancel was made due to low registration numbers and it was not rescheduled due to scheduling conflicts with key players.

Goals and Outcomes Achieved

This project had four major goals: 1) to develop new and expanded markets for Minnesota specialty crop producers; 2) to increase the volume and diversity of locally and sustainably grown specialty crops being served in school cafeterias, Minnesota restaurants, catering services, groceries, and other institutions; and 3) to increase farmers' knowledge on post-harvest handling for wholesale markets; 4) to expand demand for locally/regionally grown specialty crops.

Goal 1: Reach a large and diverse audience at events

Target: Number of participants at 8 workshops will be at least 500, and participation in the Farmer/Buyer field trips will be at least 200.

Attendance at the Farmer/Buyer Networking Sessions that were combined with post-harvest handling workshops totaled 65, Farm to Cafeteria workshop networking sessions totaled 342, and the Farm to School Field trip participants totaled 112. The latter two numbers were below our projected attendance (see beneficiaries section for a breakdown). One reason for lower than anticipated participation at the Farm to Cafeteria workshops was that the networking facilitated by Renewing the Countryside was an optional component to the eight workshops held across the state. Two workshops did not choose to include the networking, and we were unable to attend one other workshop due to inclement weather, mentioned previously. We have included some reflections on attendance numbers in the lessons learned section of this report. Despite the cancelled field trip, we were able to coordinate separate programming around the promotion of Farm to School at the Minnesota State Fair, where we organize the Healthy Local Food Exhibit in the EcoExperience every year. This year, that exhibit reached nearly 250,000 Minnesotans with the message that Farm to School is good for children, farmers, and communities. We also formed a partnership with a Statewide Health Improvement Plan coordinator in Olmstead county, who was able to set up our Farm to School display at various schools and community events in Southeast Minnesota in September and October of this year, reaching an even greater number of educators, students, school staff, and parents with the same message.

Goal 2: Increase number of relationships between growers and buyers

Target: Establish 50 new grower-buyer relationships through workshops and field trips.

- Sub-goal: Increase economic value of new specialty crop sales resulting from workshops and field trips
- Sub-goal: Increase the volume and diversity of locally and sustainably grown specialty crops being served in school cafeterias, Minnesota restaurants, catering services, groceries, and other institutions

To assess whether this and the remaining goals were reached, we conducted a follow-up survey of all event participants in order to get an idea of the impact of these workshops a few months down the road (and as the growing season comes to a close). The total number of responses equaled 142, of which 52 were producers, 37 were buyers, and 53 considered themselves “others.” We also conducted three key informant interviews, details below.

As part of our post-event evaluation surveys, we asked the question “*As a result of the event(s), how many new and useful connections did you make?*” For some events, we asked a more specific question “*How many connections did you make at the farmer/buyer networking session that you anticipate will result in a new source for local purchases / sales?*” We found that at least 284 new connections were made at all 14 events combined, averaging 2 new connections per respondent. Fifty-five percent of respondents reported making two or more meaningful connections.

Producers and buyers were asked similar questions about new farmer-buyer relationships formed as a result of these workshops. In response to the question “*Did the event(s) help you find new buyers?*” posed to producers, 12 reported the event(s) helped them find new buyers for their products, 20 said “no, but I wasn’t looking for new buyers,” twelve said “no,” and eight said “not sure.” When asked “*Since attending the networking event(s), how many new wholesale accounts did you establish as a result of connections made at the workshop?*”, a total of 14 new producer-buyer transactions were reported. When asked “Please indicate gross annual sales resulting from those new wholesale accounts”, the reported range was \$200-\$2,500, with an average of ~\$1,000 each, adding up to at least \$14,000 in new direct sales. We also asked if any of the contacts they made referred them to new buyers, to which eight producers said yes.

We also asked buyers similar questions. When asked, “*Did the networking event(s) you attended help you find new producers?*”, 12 buyers responded “yes”, 8 responded “no”, 8 answered “no, but was not looking for new producers”, and 5 answered “not sure.” Four buyers did not answer that question. When asked “*Since you attended the networking event(s), how many new producers did you begin buying from as result of connections made at the workshop?*”, a total of 37 new producer-buyer business relationships were reported. We then asked them to “*Please indicate estimated purchases resulting from those NEW relationships*”, and realized the wording of this questions was unclear, as we received a variety of answer formats. From the answers provided, we found the value of these new sales ranged from \$80-5,500, but are unable to calculate an average sales value.

After sifting through these results, we decided to dig in a little deeper to find out the answer to this question: “why were so few new wholesale accounts created, even though so many meaningful farmer-buyer connections were made at these events?” To get this information, we made some follow-up phone calls to six key producers who attended one or more events, and the feedback was very similar between them all. Below is the typical case study from the producers we talked with:

A vegetable grower who already had ten wholesale accounts attended two events – a post-harvest handling workshop and a Farm to Cafeteria Workshop, and participated in the farmer-buyer networking events at each. They made several buyer connections at the event, but were unable to meet the volume of supply the buyer needed, and knew they would not be able to increase production in the near future to do so. This is an example of someone who made several connections but they were not explicitly looking for new wholesale accounts at these events. However, they participated in the networking to better understand what the market demand is, in case anything does change on the production end, or a current buyer is no longer able or willing to buy from them, and to plan for the future. While they didn’t create a new account, they were able to strengthen relationships with buyers they already sell to, and started a new product line with

them, increasing their revenue in that way. The producer emphasized that strengthening relationships with buyers is very important to their success in the wholesale market.

We learned from these phone interviews that building farmer-buyer relationships takes more time than one farmer-buyer speed dating event can offer, but they are useful in laying the groundwork for new accounts in the future. Creating a space for multiple encounters with the same farmers/buyers to take place, much like what we did with this project, provides the opportunity for these individuals to get to know each other better, and increases the likelihood that new wholesale accounts will be created and sustained.

Goal 3: Increase specialty crop farmers' understanding of post-harvest handling for wholesale markets

Target: 50 farmers will increase their knowledge through this training

- Sub-goal: Specific alteration of post-harvest handling practices will be made as a result of workshop participation.

Based on initial feedback from post-event evaluations, we found that the majority of those who attended the post-harvest handling workshops gained knowledge in post-harvest handling, including cooling, preservation techniques, packing, and overall shelf life extension. When asked if they plan to change any of their growing or production practices as a result of the workshop, several producers said yes, by scaling up and planning ahead for new business.

We asked a similar question in our follow-up survey: *“As a result of this workshop, did you (or do you plan to) change any of your growing or production practices?”* Twenty four producers said yes, and reported changes that included implementing post-harvest handling procedures, food safety planning, scaling up, increased high tunnel growing/season extension, implemented some GAPs procedures, adjusted processing procedures, and built/remodeled buildings and/or equipment.

Comments on the post-harvest handling workshops included “Attina was a very good presenter and the book we received is very informative and a good reference to have around” and “Attina's book is a great tool to press into the wholesale Market. Have been making changes to accommodate wholesale scale production.” Others wrote “I received some good advice that I'll work into my current set up” and “I help on an organic farm, and incorporated some of the things learned into my post-harvest handling practices.”

Goal 4: Build and maintain strong relationships between farmers and buyers

Targets: Increase understanding between farmers and buyers, expand interest in sourcing local specialty crops, solidify commitment from buyers to source local specialty crops, and train growers and food service professionals to work more effectively with each other.

- Sub-goal: Expand demand for locally/regionally grown specialty crops.

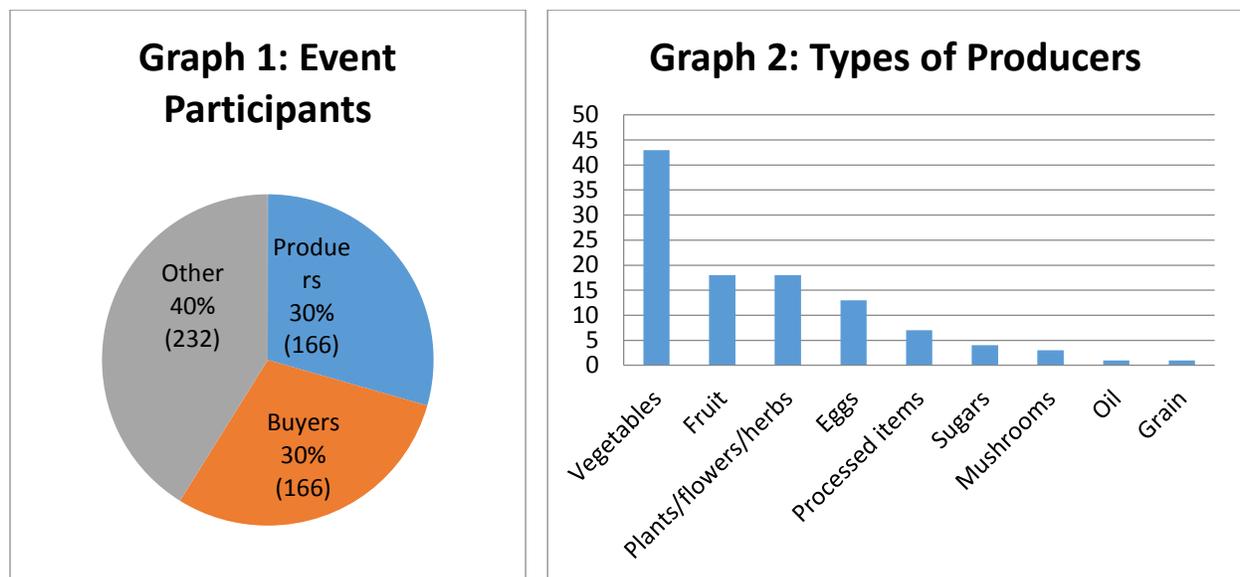
To measure our progress on this long-term goal, we asked the following question in the follow-up survey for buyers: *“As a result of this workshop, did (or do you plan to) change any of your sourcing, purchasing, or preparation practices?”* Eighteen buyers responded yes, and changes include beginning to buy local whereas they did not purchase any before, using more fresh, local vegetables when they are available, switching up some preparation techniques, looking into purchasing local meat, looking into ways to incorporate more scratch cooking with whole foods with limited staff time, planning to visit more farms and develop relationships, working with surrounding schools to combine orders and deliveries, making an official percentage commitment for local food purchasing, and working on developing a better understanding of what the farmer and end-user relationship should look like.

Responses to evaluation surveys from the Farm to Cafeteria workshops indicated that several buyers changed their opinion of farmer-buyer relationships after meeting farmers face-to-face at the event. They felt they could trust them more as suppliers. One participant realized that “it is a lot easier to make Farm to Cafeteria connections than I initially thought,” while another noted “we were already doing it prior to the workshop, but meeting the growers made me even more confident.” One school food service director found the workshop to be very useful in making new connections, stating “the connections that I made and the enthusiasm I see helps fuel my desire to grow our

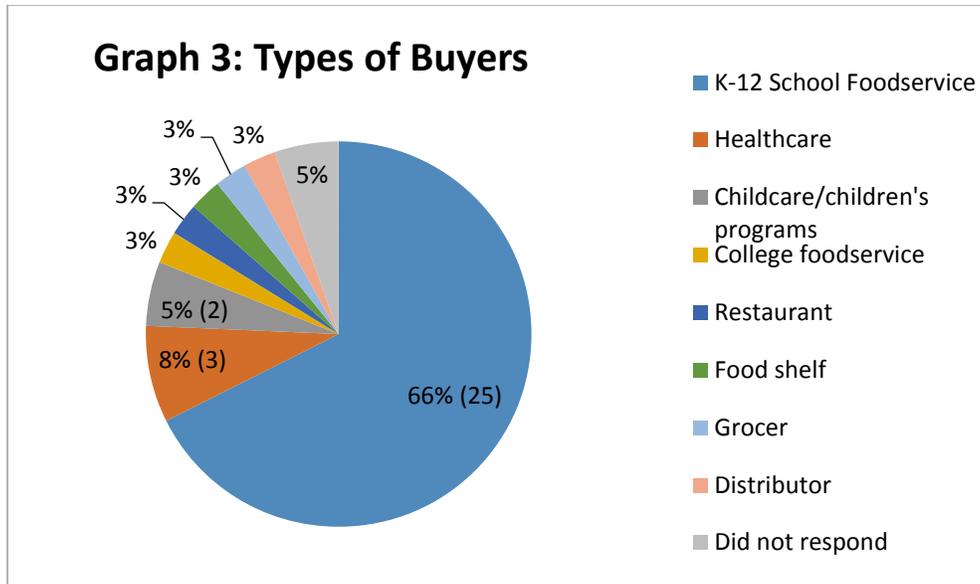
Farm to School program.” Other positive feedback included comments like “producers that I spoke (with) are genuine concerned about environment and offering high quality products,” and “It was great to see numerous people from different business sectors all coming together for a common goal of moving local foods thru our community.”

Beneficiaries

In total, 166 producers, 166 buyers, and 232 others attended the fifteen events listed below. Of the 51 producers who responded to our follow-up survey, 43 (84%) produce vegetables, 18 (35%) produce fruits, 18 (35%) produce plants/flowers/herbs, and 13 (25%) produce eggs, while a handful produce processed items (7), mushrooms (3), sugars (4), oil (1), and grain (1) (the total percentage adds up to more than 100% because many producers grow more than one thing). Two producers identified themselves as minority farmers. When asked the number of existing wholesale accounts they supply, answers ranged from 0 to 75, with 4.5 the average number, and about half of the respondents reporting zero wholesale accounts. The gross sale value to their existing wholesale accounts ranges from \$0 to \$100,000 annually, with an average of \$13,103, and nearly half of respondents reporting between \$500 and \$5,000. Several respondents did not answer that question.



The majority of buyers who responded to the follow-up survey represented K-12 food service (66%), while the others varied from healthcare (3), childcare/children’s programs (2), college food service (1), restaurants (1), food shelves (1), grocers (1), and distributors (1). Two buyers did not answer this question (see graph 3). When asked which products they would like to find new suppliers for, the majority listed fruits and vegetables and local meat, while a few mentioned grains, melons, dairy, fish, and maple syrup. When asked how many local buyers they currently purchase from, answers ranged from 0 to 75, with an average of six producers, while the majority buy from five or less producers. Four buyers reported that they are currently not buying from any local producers. We asked buyers to estimate the amount of money they expect to spend on locally sourced products by the end of 2013, and answers ranged from \$0 to \$225,000, with an average of \$80,500. The majority of buyers estimated spending below \$7,500 on locally sourced products.



<i>Farmer/ Buyer Networking Events</i>	<i>Attendance</i>
Gale Woods Farm, MN – with MISA – December 6, 2012	20
Bemidji, MN – with MISA – January 4, 2013	25
Northfield, MN – with MISA – January 26, 2013	20
Farm to Cafeteria Southwest Workshop, Lamberton, MN, February 12, 2013	30
Farm to Cafeteria East Metro Workshop, East St. Paul, MN, February 14, 2013	57
Farm to Cafeteria West Metro Workshop, Bloomington, MN, February 28, 2013	71
Farm to Cafeteria Southeast Workshop, Rochester, MN, March 7, 2013	89
Farm to Cafeteria Central Workshop, Staples, MN, April 3, 2013	95
<i>TOTAL</i>	<i>407</i>

Attendees for the first three workshops included farmers and wholesale food buyers representing restaurants, retail stores, caterers, and institutional food buyers. Farm to Cafeteria workshop attendees included K-12 school food service directors and staff, community members, local public health, hunger relief organizations, representatives of local government, and educators.

<i>Farm to School Field Trips</i>	<i>Attendance</i>
Concordia Language Villages (Bemidji, MN) – May 28, 2013	18
Verndale Public Schools (Central MN) – June 19, 2013	19
Duluth & Cloquet Public Schools (Northeast MN) – July 12, 2013	14
Burnsville-Eagan-Savage Public Schools (South Metro MN) – July 26, 2013	23
St. Paul Public Schools (East Metro MN) – August 1, 2013	20
Sibley East Public Schools (West Metro) – August 8, 2013	5
Farm to Childcare (Rochester, MN) – October 19, 2013	13
<i>TOTAL</i>	<i>112</i>

Field trip attendees included local specialty crop farmers, K-12 school food service professionals, local public health, UMN Extension, local non-profit employees, local politicians, a college professor, college and graduate school students, local newspaper staff, restaurant food buyers, community garden coordinators, local grocery co-op employees, a farmers' market manager, farming association leaders, state agency employees (MDE), hunger relief organization staff, and minority farmers. The Farm to Childcare attendees consisted of providers at in-home childcare, childcare centers, and preschools in the Southeast Minnesota area.

Lessons Learned

While attendance at some of the Farm to School Field trips was low, we realize now that our projection was unrealistically high, and a smaller group of participants (up to 20) was actually ideal for this particular type of programming. We also realized through this process that the summer months, although the ideal time for a farm tour, is not an ideal time of year for farmers and school food service professionals to attend these events, as it is the busiest time of year for farmers, and school food service staff are usually on summer vacation. We hired a temporary summer intern in July, who assisted with promotion and marketing of the field trips, which led to an increase in attendance for most of the remaining field trips.

The number of new buyer/producer wholesale accounts established was also a disappointing shortfall from the initial estimate we made. As was mentioned earlier in this report, however, we heard from a majority of survey respondents that the opportunity to meet potential buyers was a valuable use of their time. We know from past networking events that new relationships between buyers and growers are rarely established at, or in the immediate aftermath of the workshop. It is more likely that repeated exposure to new markets and producers will result in new wholesale accounts. One new farmer expressed that his intent was never to add a new wholesale account, but rather get a glimpse into what the potential market for his product would be as a way to gauge and manage his growing potential. Another farmer said she always attends the networking workshops when available so she gets to meet her customers face-to-face even though she sells through a regional distributor. 25% of respondents indicated they did meet new buyers, but nearly 40% indicated that they were not looking for new buyers. Interestingly though when asked if they would attend the event again 87% of buyers and producers said “yes” and 80% indicated they would be most interested in meeting new buyers or producers.

Contact Person(s)

Brett Olson, Creative Director - brett@rtcinfo.org; 612-910-7601

Molly Turnquist, Program Manager - molly@rtcinfo.org; 612-210-8875

Renewing the Countryside



FINAL BUDGET REPORT

	<i>BUDGET</i>	ACTUAL
A. Personnel	\$ 25,872.00	\$ 26,658.60
B. Fringe Benefits	\$ 6,468.00	\$ 7,110.15
<i>C. Equipment</i>	\$ -	\$ -
D. Supplies	\$ -	\$ -
E. Contractual	\$ 7,000.00	\$ 7,240.00
<i>F. Other</i>		
a. Field Trip Costs	\$ 6,400.00	\$ 5,700.82
b. Communications	\$ 600.00	\$ 732.18
c. Speaker fees	\$ 1,600.00	\$ 1,100.00
d. Printing	\$ 2,060.00	\$ 1,458.25
Total Costs	\$ 50,000.00	\$50,000

Additional Information

We posted information about the events on our website as well as our Facebook page:

- <http://renewingthecountryside.org/producer-buyer-networking>
- <http://renewingthecountryside.org/farm-school>
- <https://www.facebook.com/renewingthecountryside>

An article was published in the Pioneer Press about our Farm to School workshop in Burnsville, Minnesota:
http://www.twincities.com/ci_23741957/learning-love-vegetables

Photos from the Farm to Cafeteria Workshops – February 2013



Stephen Jones, Superintendent of Little Falls Community Schools – Opening Speaker



Mary Quinn McCallum and Michelle Wall, St. Paul Public Schools Green and Healthy Kids Advisory Group – Breakout session on parent and community member involvement with improving school food environments



Barb Mechura, Hopkins Public Schools and Greg Reynolds, Riverbend Farm – Breakout session on navigating farm to school contracts

Photos from Farm to School Field Trips

Central MN: Farm tour at Gardens Gourmet farm in Henning, MN



Northeast, MN – Duluth Public Schools and Cloquet Public Schools kitchen tour



Northeast, MN – Tour of Food Farm in Wrenshall, MN



South Metro, MN – Burnsville-Eagan-Savage Public Schools kitchen tour



South Metro, MN – Woodhill Urban Farm tour



East Metro, MN – St. Paul Public Schools' nutrition center



East Metro, MN – Laughing Loon Farm in Northfield, MN



West Metro, MN – Sibley East Schools' Student Farm in Arlington, MN



Project 9

MN Specialty Crop Block Grant FINAL PERFORMANCE REPORT

Submitted by: Kathy Zeman, Operations Manager, Minnesota Farmers' Market Association (MFMA) Phone: (320) 250-5087; e-mail: kzeman@mfma.org

Date: 2015-11-30

PROJECT TITLE

Learn Life-Long Healthy Cooking at Your Farmers' Market, Contract #54784

PROJECT SUMMARY

Farmers' markets across Minnesota represent an overwhelming number of our state's direct-marketing opportunities for specialty crop growers. These growers, along with their farmers' market leadership, are individuals well-suited to encourage and demonstrate how to prepare the fruits and vegetables they are producing within Minnesota. Vegetable growers in particular reported to MFMA that consumers wish to increase their vegetable intake but are unsure of how to select and then prepare vegetables that

they've not yet experienced and/or prepared. All ages are more inclined to desire fruits and vegetables when they have had an opportunity to experience them directly; and adults are more inclined to purchase them if they're confident in being able to prepare the items.

As acceptance of SNAP (Supplemental Nutrition Assistance Program, formerly known as food stamps) at Minnesota farmers' markets increased, so did the need to provide education on the often unfamiliar produce to these food-insecure consumers. Promoting demonstrations and sampling was a perfect way to show SNAP consumers methods of preparing healthy local fruits and vegetables for their families.

Yet laws at the time of this grant's inception regarding sampling and demonstrations at farmers' markets were complex and difficult to interpret, since they were written not for farmers' markets. Enforcement of the laws was carried out by either the Minnesota Department of Agriculture (MDA) or Health (MDH) depending on how much processing went into the final sampled product and whether all ingredients were grown by the farmer doing the sampling/demonstration. In addition, dozens of cities and counties have 'delegated authorities' who carry out enforcement of these laws with their own different interpretations.

In a nutshell, specialty crop growers knew they could increase sales and consumption of their crops by sampling and demonstrating preparation methods but had no clear and consistent information as to the laws, licenses and equipment they needed. In addition, markets are typically managed on a shoestring budget by volunteers, with little time or money to research and purchase necessary equipment for produce sampling and demonstrations.

This grant sought to equip and educate markets across the state; urban, suburban, and rural; on how to safely, effectively, and legally perform specialty crop cooking demonstrations and samplings to increase sales and consumption of specialty crops.

PROJECT APPROACH

All references to specialty crops below are highlighted. The only food sampling / demos allowed with this grant were for specialty crops. Attached is a blank copy of the application every market had to complete; at the end of page 2 is an affidavit the market manager had to complete, indicating their compliance with using these grant dollars for specialty crop only.

In the beginning, this project set out to work with 12 markets to help purchase equipment, recipe cards and licenses needed to sample food at farmers' markets. As we began to delve more deeply into the conflicting, sometimes contradictory information coming from enforcement divisions of the MDA, the MDH and different Delegated Authorities, the MFMA decided to bring all these partners to the table to problem-solve the issues.

Working collaboratively with these groups, we were able to clearly define rules for sampling at Minnesota farmers' markets, when licenses were needed, when they weren't, and what kind of equipment was needed to safely perform specialty crop cooking demonstrations and sampling specifically at farmers' markets. (NOTE: NO grant money was used during this effort to resolve licensing issues for food sampling at farmers' markets. We used only MFMA money to do this work.)

With that clear knowledge and delineation of oversight, the MFMA was able to drastically reduce projected licensing and equipment costs so that up to 75 markets could participate in this program, eliminating the need to pick just 12 markets from the 200+ that exist in Minnesota.

Ten different recipe cards were developed utilizing specialty crops with emphasis on simple, kid-friendly dishes that required little more than prep and mixing. They also focused on the health benefits associated with consumption of the featured specialty crop.

Hand washing kits were assembled from simple components that were easy to find and replicate should a market or vendor wish to do so. These were sent to markets after they applied for the program through the 2014 and 2015 market seasons. These simple, effective kits were tested by University of Minnesota Extension health and safety experts and approved by the MDH. Rules for specialty crop sampling and demonstrations were sent along with them.

A two-part \$150 sampling stipend was sent to the participating markets. The first \$75 was sent after a pre-season survey was completed detailing the market's previous year of specialty crop sampling and demonstration. The second \$75 check was sent after markets submitted a photo of the hand washing station at their market and a post-season survey detailing specialty crop sampling and demos in the 2014 or 2015 Market season, depending on their year of participation. These surveys also measured SNAP outreach. The stipend was used for specialty crop sampling/demo staffing, purchase of specialty crop ingredients or supplies, promotion or a combination of the three as chosen by Markets on their applications.

In conjunction with University of Minnesota Extension food safety experts, a specialty crop safe food handling training course was developed and held at locations across the state.

Markets of vastly different sizes applied from all over the state. In a state where 2/3 of the population lives in one metro area of 14 counties, it was exciting to have markets in more than half of Minnesota's 87 counties participate to improve their ability to sell local specialty crops. Out of the 45 markets that completed the 2014 pre-season survey, only 5 offered a cooking demonstration or sampling in 2013 and only 7 had handwashing facilities appropriate for sampling or demos. In the 2014 season, only one of the post-survey respondents didn't offer a specialty crop demonstration or sampling (and that market did in 2015).

In the 2015 season, the additional 24 participating markets included 5 markets less than 2 years old. It also included established markets like Duluth, St. Joseph, Bloomington and Hibbing - all which have been operating for extended time periods. In the 2014 season, only 8, or 1/3 had offered a specialty crop sampling or demonstration at their market in the previous year and only 4 had sampling/demo-appropriate handwashing facilities. Of the 23 markets that submitted a post-season survey, all have offered (or will have offered by season's end) specialty crop cooking demonstrations and/or samplings.

The Project Coordinator spent considerable one-on-one time with the 69 participating Market Managers and other market volunteers/staff, answering questions and verifying survey data from overworked and

underpaid (if paid at all) market management. Local Extension educators and market vendors had many questions as well. The initial estimate of time required for project coordination was far too low.

While it is impossible to put an exact figure on the increase in sales of specialty crops due to the success of this program, we heard from many market managers who told us that it dramatically increased sales of the featured specialty crop.

Hoa Sobczynski in International Falls on the Canadian border remarked, "This is a fantastic program and our market has certainly grown due to to it." Lynn Brand in Fergus Falls, just 20 miles from the North Dakota border said, "The program was so successful overall that we found other recipes to use that were not provided, and we will continue to structure the program next year. Our buyers looked forward each week to the experience. I also used a large board to indicate which vendors had the produce in question." Iris Newman in the small southern Minnesota city of Eyota said, "The demos/samples definitely augmented sales at the market and taught people easy ways for preparing healthy foods." Sara George in Wabasha noted, "We had customers coming for weeks that wanted to buy more of the products we sampled so they could use the recipe we did at the market. It was a HUGE success at our market."

Our conclusions at the end of this program are that enabling and encouraging specialty crop samplings and demos are a very effective way to engage and educate consumers about local specialty crops and to encourage increased sales and consumption.

Legal issues, rules and regulations surrounding safely conducting demos and sampling have been simplified, clarified and are much more accessible. The equipment needed to conduct demos and sampling has also been clearly established with simple, accessible and affordable components. It is the time and resources needed to conduct these services that still remain a major barrier to enabling this valuable produce promotion and education technique.

Going forward, MFMA leadership will be analyzing ways to build on the success of this program by focusing on the weakest link: the time and effort needed to organize specialty crop demos and sampling during peak market season. Whether collaborating with regional SHIP (State Health Improvement Program) employees, Extension educators, VISTA community workers or local businesses and volunteers, Minnesota farmers' markets could continue expansion of specialty crop sales and consumption with more assistance on this logistical challenge.

This program:

- ◆ **Provided hands-on food safety training, taught by the University of Minnesota Extension (UME), at MFMA's 2014 spring conference.**
- ◆ **Developed written training materials for markets and vendors on the new 'safe food sampling at farmers' market' law. This material was reviewed by the Minnesota Department of Agriculture (MDA), the Minnesota Department of Health (MDH) and the UME.**

- ◆ Designated a page on MFMA's website specifically for the training material on safe food sampling and specialty crop cooking demonstrations at farmers' markets.
- ◆ Coordinated with UME multiple regional face-to-face (F2F) trainings for farmers' market managers and vendors on food safety and safe food sampling at farmers' market' law.
- ◆ Coordinated with UME to develop three safe food sampling videos that are available on UME's and MFMA's websites.
- ◆ Contracted with Budding Farmers™ to develop recipe cards for the specialty crop cooking demos. The recipe cards featured specialty crops and nutrition facts. MFMA printed and distributed the specialty crop recipe cards to participating farmers' markets and distributed the digital templates for free to all markets, communities and educators.
- ◆ Constructed and distributed handwashing stations to 69 participating farmers' markets. The handwashing stations are required by the new safe food sampling at farmers' market' law and consisted of: insulated 5-gallon beverage dispenser, retrofitted free-flow faucets, hand soap, paper towels, nail brush and fact sheet on proper handwashing.
- ◆ Provided a \$150 stipend to farmers' markets offering specialty crop cooking demos and sampling.
- ◆ Interactive food safety training occurred:
 1. March 20, 2014: MFMA's Spring Conference; by UME: 78 attendees
 2. June 19, 2014: Thief River Falls, by UME: 8 attendees
 3. July 9, 2014: Little Falls, by UME: 17 attendees
 4. Sept. 3, 2014: St. Charles, by UME: 18 attendees
 5. Nov. 6, 2014: MFMA's Fall Videoconference: 92 attendees
 6. March 11, 2015: Bemidji, by UME: 16 attendees
 7. April 22, 2015: St. Cloud, by UME: 13 attendees
 8. April 22, 2015: Marshall, by UME: 10 attendees
 9. May 6, 2015: Albert Lea, by UME: 13 attendees
 10. May 13, 2015: Hutchinson, by UME: 51 attendees
 11. May 19, 2015: Alexandria, by UME: 23 attendees
 12. May 29, 2015: Stillwater, by UME (canceled due to low enrollment)
 13. August 24, 2015: Little Falls, by UME (canceled due to low enrollment)

The 11 trainings in 2014 and 2015 reached a total of 339 farmers' market vendors, managers, nutrition educators and public health staff.

- ◆ **Developed, distributed and analyzed a pre-season survey and a post-season survey with farmers' market managers to assess the impact of program participation on specialty crop cooking demonstrations and food sampling at their markets.**

Significant partners:

- ◆ **MDA: analysis and guidance on implementing the safe food sampling at farmers' market law. Review and guidance on MFMA's training materials.**
- ◆ **MDH: analysis and guidance on implementing the safe food sampling at farmers' market law. Review and guidance on MFMA's training materials.**
- ◆ **UME: review and guidance on MFMA's training materials, as well as providing the bulk of the training.**

GOALS AND OUTCOMES ACHIEVED

Measurable Outcome #1:

Educate Farmers' Market representatives and specialty crop growers in Food Safety/Handling by integrating the training into existing workshops held across the state. Food safety/handling training, specific to the specialty crop industry and cooking demonstrations at farmers' markets will be provided. The training can be supplied to an unlimited number of attendees at these workshops and the number of persons successfully completing the training will be reported on an annual basis as maintained by the MFMA.

*** Outcome: Accomplished – and Ongoing**

MFMA worked collaboratively with MDA, MDH and UME to design & develop the following materials:

- 1. Safe Food Sampling Worksheet (MFMA)**
- 2. Safe Food Sampling at Farmers' Market Checklist (UME)**
- 3. Safe Food Sampling Tips for Framers' Market Vendors (UME)**
- 4. Video: Germ Transfer to Gloves (UME)**
- 5. Video: Germs on Produce (UME)**
- 6. Video: Germs on Hands (UME)**

These printed materials and videos are accessible online any time. Furthermore, MFMA and our partners have these materials on a schedule to be reviewed annually and revised as needed.

Interactive food safety training occurred:

- 14. March 20, 2014: MFMA's Spring Conference; by UME: 78 attendees**
- 15. June 19, 2014: Thief River Falls, by UME: 8 attendees**
- 16. July 9, 2014: Little Falls, by UME: 17 attendees**
- 17. Sept. 3, 2014: St. Charles, by UME: 18 attendees**
- 18. Nov. 6, 2014: MFMA's Fall Videoconference: 92 attendees**
- 19. March 11, 2015: Bemidji, by UME: 16 attendees**
- 20. April 22, 2015: St. Cloud, by UME: 13 attendees**
- 21. April 22, 2015: Marshall, by UME: 10 attendees**
- 22. May 6, 2015: Albert Lea, by UME: 13 attendees**
- 23. May 13, 2015: Hutchinson, by UME: 51 attendees**
- 24. May 19, 2015: Alexandria, by UME: 23 attendees**
- 25. May 29, 2015: Stillwater, by UME (canceled due to low enrollment)**
- 26. August 24, 2015: Little Falls, by UME (canceled due to low enrollment)**

The 11 trainings in 2014 and 2015 reached a total of 339 farmers' market vendors, managers, nutrition educators and public health staff.

Measurable Outcome #2:

Offer mini-grants for up to 75 farmers' markets in Minnesota to be trained, equipped and licensed to provide specialty crop cooking demonstrations. Once other markets in the state see the success of this pilot project then we expect to see specialty crop cooking demonstrations as a common practice across Minnesota's farmers' markets.

Outcome: Accomplished

Although our goal was 75 markets, we are pleased to have had 69 markets sign up to participate in specialty crop cooking demos & sampling in 2014 and 2015. Due to the April 10, 2014 signing of the safe food sampling at farmers' markets law – and then the intense work to create all the training materials that then needed to be reviewed and approved by MDA, MDH & UME – signing markets up happened a year later than originally hoped for.

Once the new law was passed, MFMA had markets apply to participate in this grant program. Now that licenses were not required for sampling and demos specifically at farmers' markets, the grant provided everything needed to do the cooking demos:

- 1. \$150 stipend to purchase specialty crops from their vendors for the demos, reimburse a chef to do the cooking demos and/or pay for promotions of the demos.**

2. The mandated handwashing station: 5-gallon thermos, hand soap, paper towels and nail brush.
3. Colorful, simple kid-friendly printed recipe cards featuring specialty crops.

Based on the surveys, we saw over a four-fold increase in markets doing specialty crop demos (from 12 to 50). We more than tripled the number of markets offering specialty crop food samplings (from 16 to 54). On the food safety front, we also increased the number of handwashing stations at the markets by seven-fold (from 9 to 68).

Considerable one-on-one time was spent between the Program Coordinator and individual markets for troubleshooting, legal questions, and general 'coaching' and data collection.

Measurable Outcome #3:

Support the overall increase of state and national redemption of SNAP benefits at Farmers' Markets from the 2009 national rate of .008% (of \$50,359,917,015) to .011%. This data is supported by USDA FNS reporting.

*** Outcome: Partially Accomplished**

We designed our surveys to capture this information as well as to stimulate growth in both SNAP support and promotion of the specialty crop cooking demos & sampling. Only three additional markets began accepting SNAP between the previous baseline season and the Safe Food Sampling Program season, while one market, Duluth, ceased to accept SNAP funds. While we had hoped for greater expansion of markets accepting SNAP among program participants, there was no specific programming or funding in this program to facilitate that. The \$18.8 million spent at U.S. farmers' markets in 2014 represents almost a 6-fold increase over 2008 figures.

The enormous growth (733%) in specialty crop sampling and demonstration outreach to SNAP participants was very encouraging, however, and helpful in increasing SNAP redemptions at SNAP-authorized markets.

Before this grant:

- ◆ 26 of the reporting markets accepted SNAP.
- ◆ 3 of the reporting markets did outreach to SNAP participants specifically on specialty crop cooking demos and sampling.

With the help of this grant:

- ◆ 28 (7% increase) of the reporting markets accepted SNAP.
- ◆ 22 (733% increase) of the reporting markets did outreach to SNAP participants specifically on the specialty crop cooking demos and sampling.

Measurable Outcome #4:

Facilitate and document the coordination and understanding between farmers' markets and the agencies required to license and inspect cooking demonstration activity at our Minnesota Farmers'

Markets; by developing (under approval of Minnesota Department of Health and Minnesota Department of Agriculture's Food & Dairy Inspection Division) and distributing the "How to Conduct Cooking Demonstrations at Your Farmers' Market" document to farmers' market representatives and specialty crop producers throughout Minnesota.

*** Outcome: Accomplished**

MFMA worked collaboratively with MDA, MDH and UME to design & develop the following materials:

1. **Safe Food Sampling Worksheet (MFMA)**
2. **Safe Food Sampling at Farmers' Market Checklist (UME)**
3. **Safe Food Sampling Tips for Framers' Market Vendors (UME)**
4. **Video: Germ Transfer to Gloves (UME)**
5. **Video: Germs on Produce (UME)**
6. **Video: Germs on Hands (UME)**

These materials and videos are accessible online any time.

Measurable Outcome #5:

~~{{ **Measurable Outcome #5: Provide a 15% increase in the sales of local fruits and vegetables at our Minnesota Farmers' Markets; by advocating basic nutrition practices and assisting community residents in developing basic cooking skills using fruits and vegetables. This will be accomplished by** Develop and distribute recipe cards (detailing selection, storage and preparation of locally grown specialty crop ingredients) to cooking demonstration participants.~~

The reason that language was deleted was because when this grant was written and implemented by former MFMA staff, they did not perform a baseline analysis of the current specialty crop sales...thus making it impossible to measure any kind of a change in specialty crop sales. Therefore, when we (current MFMA staff Jesse Davis and Kathy Zeman) inherited this grant project and recognized that problem, we changed the outcome to reflect something we could measure.

Develop and distribute recipe cards (detailing selection, storage and preparation of locally grown specialty crop ingredients) to cooking demonstration participants.

*** Outcome: Accomplished**

MFMA contracted with Budding Farmers™ to develop 10 easy, kid-friendly recipes featuring specialty crops. The 10 specialty crops featured in the recipes:

1. **Apple – Nutty Apple Snack**
2. **Basil – Sunny Basil Pesto**
3. **Beets – Shaved Beet Salad**

4. **Cabbage – Cabbage & Apple Slaw**
5. **Carrots – Carrot & Raisin Slaw**
6. **Cucumbers – Marinated Cucumber Salad**
7. **Kale – Kale & Strawberry Salad**
8. **Summer Squash – Zucchini, Mint & Feta Salad**
9. **Tomato – Fresh Tomato Bruschetta**
10. **Watermelon – Watermelon Salsa**

Not only did the MFMA distribute the recipe cards to all 69 participating farmers' markets, but we've made the easy-to-print PDF templates available to any interested markets, specialty crop growers and other organizations.

BENEFICIARIES

This project benefited three major groups:

- **69 Minnesota Farmers' Markets where specialty crops are sold**
- **Farmers who grow specialty crops sold at these 69 Minnesota farmers' markets**
- **Minnesota consumers wanting to taste and sample specialty crops**

Minnesota farmers' markets benefited in many ways. This program enabled the MFMA to become a clearinghouse for information and resources regarding conducting sampling and demonstrations for specialty crops. Before this program, information provided by the MDA, MDH, UME and additional Delegated Health Authorities was often contradictory, and at the very least un-definitive. It was challenging to get a clear answer.

By collaborating with all these parties, a clear 'roadmap' for specialty crop sampling and demos has been defined and markets can move forward without fear of breaking rules. Having approved equipment, specifically the handwashing station, not only has provided the means to effectively and legally carry out specialty crop samplings and demos but serves as a prototype to be copied in the future.

Any time questions arose, MFMA staff was able to answer questions and lead markets to additional ideas and resources. Expenses for printing specialty crop recipes, promotion, produce and labor were subsidized by participation in the program, easing the financial burden of offering specialty crop samplings and demos. By offering this service to its vendors, markets were able to add value to their grower membership and stakeholders.

Specialty crop farmers at participating markets benefited as well. In addition to having consumers safely and legally sample their specialty crops during market demos, growers used the handwashing kit to personally sample their produce at least 70 times, potentially much more, when the market wasn't using

the kit. They were able to better educate consumers about the taste and preparation methods of their specialty crop. They also learned how to build their own handwashing station.

Consumers of specialty crops were a beneficiary too, learning more about local specialty crops, how they tasted and when they are seasonally available. The recipe cards showed how to prepare these specialty crops in simple, healthy flavorful ways with clearly delineated steps that were safe for children.

Simple surveys were created to measure baseline data (demos and sampling information before the grant) and results after the program. The \$150 stipend was connected to completion of these two surveys: \$75 after completion of the pre-season survey and another \$75 after completion of the post-season survey and submission of a photo of the sampling kit in action at their market. Additionally, market managers had to sign an agreement that they would use the items provided by this grant solely on specialty crop cooking demos and food sampling. This helped ensure maximum participation and the most accurate statistical data.

PRE-Season Survey Info (Before the Grant)

Total markets signing up for the program	69
# of markets returning the pre-season survey	67

Of The 67 Markets Completing the PRE-Season Survey

How many offered <i>cooking demos</i> before the program?	12 mkts; 31 instances
How many had appropriate handwashing facilities for these <i>cooking demos</i> ?	11
How many distributed recipe cards for these <i>cooking demos</i> ?	10
What types of foods were featured in these <i>cooking demos</i> in 2013?	22 instances of specialty crops, plus tacos & ice cream
How many offered <i>food samplings</i> ?	16; 102 instances**
How many had appropriate onsite handwashing facilities for these <i>food samplings</i> ?	15
How many accepted SNAP?	26
How many promoted <i>cooking demos</i> or <i>food sampling</i> to SNAP participants?	3

*35 instances were from one market

POST-Season Survey Info (With the Grant)

Total markets signing up for the program	69
# of markets returning the post-season survey	65

Of The 65 Markets Completing the POST-Season Survey **Percentage Change**

How many offered <i>cooking demos</i> ?	51 markets;* 143 instances*	425%; 461%
How many had appropriate onsite handwashing facilities for these <i>cooking demos</i> ?	65	591%
How many distributed recipe cards for these <i>cooking demos</i> ?	65	650%

What types of foods were featured in these <i>cooking demos</i> ?	Over 45 specialty crops	205%+ (increase in diversity of specialty crops being used in demos)
How many offered <i>food samplings</i> ?	54 markets;* 177 instances*	338%; 174%**
How many had appropriate onsite handwashing facilities for these <i>food samplings</i> ?	65	433%
How many accepted SNAP?	28	7%
How many promoted <i>cooking demos</i> or <i>food sampling</i> to SNAP participants?	22	733%
How many markets let <i>vendors</i> use the SFS kit to offer specialty crop <i>food samples</i> ?	34	N/A

* An additional 47 samplings and demos were/are planned by markets in 2015 after final market reporting was due on 9/7/15, including a demonstration by a market yet to conduct either a demo or sampling up to that date.

**If the one outlier market that conducted 35 samplings before participating was excluded from the statistical group, the percentage would be 268%, not 174%

LESSONS LEARNED

As mentioned earlier, the vastly underestimated time needed for the project coordinator to work one-on-one with market managers and other volunteers demonstrates just how little time many Minnesota farmers' market managers have to implement new projects during peak season, no matter how positively they may impact sales. It is estimated that 2/3 of Minnesota farmers' market managers receive no compensation, balancing paying jobs with their volunteer work to improve access to fresh local food.

A lot of 'coaching' and reminders will be needed in the future to keep the positive momentum of this program going in the future, especially for markets where management/leadership changes occur. This is particularly apparent in markets where VISTAcrops or other community service program workers are involved – these workers typically only serve one-year terms, at which time much of the knowledge and experience disappears.

From mid-July to Mid-September, market manager time is at an extreme premium, yet local specialty crops are at their peak production levels. Specific planning for demos and sampling taking place during these times needs to be planned months in advance. However, sampling and demos are a perfect opportunity to ramp up interest, sales and consumption of early and late season produce such as rhubarb, lettuce, and kale as well as Brussels sprouts, parsnips and winter squash. These are also typically times when markets struggle to increase traffic at their markets.

As mentioned previously by the Wabasha market manager, customers came back for several weeks after demos and sampling occurred to get more of the featured produce, but continual effort and planning needs to be in place to line up produce, volunteers, promotions and execution.

The least realized goal of this project was the most hard to quantify: increasing SNAP usage at markets. Just as the scarcity of market manager time resources was identified as the #1 impediment to conducting specialty crop sampling and demos, the same challenge exists for SNAP implementation, promotion and incentives. It takes time, collaboration and technical expertise to run a successful SNAP program at a farmers' market, and a doubling of effort (if not tripling) to pair it with a SNAP incentive program. Yet without an incentive SNAP-matching program, SNAP sales fizzle. Duluth, the third largest city in Minnesota (second, if you don't count the Minneapolis suburb of Bloomington, home of the Mall of America) and one of the oldest farmers' markets in the state dropped SNAP altogether in 2015, unable to coordinate staffing, accounting or sufficient promotions to make the program cost-effective.

Nationally, SNAP redemptions at farmers' markets are up significantly. Here in Minnesota, current levels aren't readily available, but while redemptions are most likely much higher than a few years ago, the number of markets accepting SNAP is plateauing, due in large part to the logistical challenges for smaller markets. Larger, more sophisticated markets and markets that are run by cities/municipalities can take advantage of innovative outreach and incentives, and success builds upon success, especially as word of mouth is the #1 way SNAP recipients learn about SNAP acceptance and incentives at farmers' markets.

For a newer, smaller market however, whether in the Twin Cities' suburbs or rural Minnesota, the initial 'buy-in' is often too high, even with several programs aimed at equipping markets with machinery and incentive programs.

On a positive note, approximately 1/3 of markets participating in this program made a special effort to perform outreach to SNAP recipients about the samplings (a 733% jump!). That leads the MFMA to conclude that specialty crop food samplings and demonstrations hold an important key to engaging and educating SNAP recipients about the benefits of accessing healthy local produce at their local farmers' market. Reviewing some of the reported outreach portals such as local social services and food bank resources also leads to a conclusion that taking the market sampling resources directly to these portals could be very effective for markets to engage SNAP recipients with ways to access consumption of incentivized local specialty crops.

ADDITIONAL INFORMATION

Photos of the Safe Food Sampling Kit at Minnesota farmers' markets, copies of the 10 specialty crop recipe cards, safe food sampling rules and other resources gladly available upon request.