Final Report
Grant No. 12-25-B-0959
Specialty Crops Block Grant Program
Wisconsin Department of Agriculture, Trade and Consumer Protection

Modified Report Due Date: December 29, 2012

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Secretary

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INTRODUCTION

The Wisconsin Department of Agriculture received $745,360.82 from the Specialty Crop Block Grant Program, Grant No. 12-25-B-0959. The Department was able to fund 19 projects to promote and improve specialty crops industries in the state of Wisconsin or the Midwest and funding a SCBG Manager to administer and promote the Specialty Crop Block Grant program. WI DATCP used 10% of the funds to cover administrative costs for the finance department to track and disperse the funding.

Enclosed are the reports submitted by all 20 grantees.

Grant Projects:

1) FY09FB-001 Detecting pathogen activity in potato storages
2) FY09FB-002 Cultural control practices for pea production
3) FY09FB-003 Epidemiology of the astor yellows phytoplasma
4) FY09FB-004 Potato systems for improved management
5) FY09FB-005 Farm fresh connections
6) FY09FB-006 Wisconsin grape industry project
7) FY09FB-007 Improving bush-type hazelnuts for commercial production
8) FY09FB-008 Processing fruits and vegetables for Wisconsin schools
9) FY09FB-009 Promotion of Wisconsin Grown Potatoes - A Buy Local
10) FY09FB-010 Evaluation of new trees for the Midwest urban environment
11) FY09FB-011 Wisconsin Buys Local: Tomatoes-Apples-Potatoes
12) FY09FB-012 Cranberry Energy Conservation Program
13) FY09FB-013 GAP/GHP Cost Share Program
14) FY09FB-014 Survey for Corky Ringspot Disease of Potatoes in Wisconsin
15) FY09FB-015 Pest Detection in WI Vegetable Crops
16) FY09FB-016 Buy Local, Buy Safely
17) FY09FB-017 A Consumer's Guide to Organic Foods FY09FB-018
18) FY09FB-018 Sustainable Farming Practices for Underserved Fresh Market Growers
19) FY09FB-019 SavorWisconsin.com
20) FY09FB-020 Specialty Crop Grants Specialist

1) Wisconsin Potato and Vegetable Growers Association

Project Title: Detecting pathogen activity in potato storages by monitoring low-molecular weight volatile compounds (FY09FB-001)

Total Amount Received: $27,815

Date of Award: December 1, 2009

Project Contact(s): Paul Bethke

Report Date: October 31, 2012

I. Project Summary

Potato production and processing are important components of Wisconsin agriculture. The annual Wisconsin potato crop of 2.5 billion pounds is grown on approximately 63,000 acres and valued at $200 million. Substantial added value occurs though distribution, storage and the production of processed potato products including potato chips and partially processed French fries. Two thirds of the Wisconsin potato crop is put into temperature-controlled storage for three to ten months in order to provide raw product for processing and fresh markets throughout the year. Losses in storage resulting from rot and degraded quality can be substantial. Annual losses caused by rot in Wisconsin have been estimated at 5-20% since 2000. Losses resulting from unacceptable quality may be as high as 20% for processing potatoes. Stringent requirements for tuber quality include specifications for color after frying and reducing sugar (glucose and fructose) content. Tubers with elevated reducing sugars produce dark colored, bitter tasting products after frying that are undesirable to consumers. Because crop value is only realized once distributors or processors accept tubers, the economic cost of storage losses falls disproportionately on growers who have made a substantial investment in producing and harvesting the crop.

Several microorganisms cause significant losses of stored potato tubers including the soft rot pathogens (Pectobacterium carotovorum and Pectobacterium atrosepticum), the dry rot pathogens (predominantly Fusarium sambucinum), leak (Pythium ultimum), late blight (Phytophthora infestans) and pink rot (Phytophthora erythroseptica). Rot that is localized in a potato storage early in the storage season can spread throughout the pile of tubers as the season progresses. Storage ventilation systems circulate the air to maintain precise temperature and humidity control, but also distribute fungal spores and bacteria. Tubers infected with soft rot pathogens decay into slimy masses that spread the infection to nearby tubers. Detecting the onset of rot in potato storages is highly desirable because it allows management decisions to be made before substantial losses are incurred. In many cases, however, the pathogens that cause losses due to rot or degraded quality are not detected early. Potatoes are stored to a depth of 18 feet, and this makes most of the crop unavailable for visual inspection. Storage managers instead rely heavily on the smell of the storage atmosphere for crop assessment. Moisture leaking from

rotting tubers into the ventilation system is another detection method, but this method only identifies problems that are well under way. Researchers have identified volatile compounds produced by pathogen-infected tubers [1-6], and attempted to develop volatile fingerprints for individual pathogens [1, 2, 4, 6, 7]. The long-term goal of these previous research studies was to develop assays for detecting volatile compounds produced by pathogen infected tubers with greater sensitivity and specificity than could be achieved by the human nose. Although numerous volatile compounds were identified, the presence and amount of most were found to depend on the specific pathogen, the time of infection, the sample assayed, the presence of other secondary pathogens, and on storage conditions. This combination of complexity and uncertainty has prevented volatile monitoring from being adopted as a tool by industry. An alternative, simpler approach that remains highly informative is to identify a general increase in pathogen activity without trying to identify individual pathogens. No single volatile compound is a reliable marker for all pathogens, but multiple researchers have identified a few common volatiles across a range of pathogens and storage conditions (Table 1). These include low molecular weight alcohols, acetone, and, ethylene. Ethanol, acetone, 1-propanol, 2-propanol and 1-butanol are end products of fungal or bacterial fermentation reactions. It is likely, therefore, that these volatile, low molecular weight compounds were identified in multiple studies because their production is tightly coupled to the growth of the pathogen. Interestingly, storage managers use the presence of fruit flies as an early sign of rot, and fruit flies are attracted to various alcohols. Hence, fruit flies may be serving as bio-monitors for some rot-associated volatiles. Potato tubers that are not infected with rot pathogens emit volatiles at much lower rates than infected tubers [3, 5, 8, 9], and this observation further suggests that this approach may be successful.

Table 1. Volatile compounds evolved from potato tubers infected with rot pathogens. Abbreviations refer to the specific pathogen(s) used to infect tubers in each of the five studies.

	Volatile compound identified				
Prior study	Ethanol	Acetone	1-Propanol	2-Propanol	1-Butanol
Lui, 2005	PCC, PCA	PCC, PCA	PCC, PCA		PCC, PCA
De Lacy Costello, 2001		PI	PI, FC	PI, FC	
De Lacy Costello, 1999		AB, BP,PCC			PCC
Waterer, 1985	PCC, PCA		PCC,PCA	PCC, PCA	PCC, PCA
Varns, 1979	PCC	PCC	PCC		

Abbreviations: AB, Arthrobacter sp; BP, Bacillus polymyxa; FC, Fusarium coeruleum; PCA, Pectobacterium carotovora subsp. atroseptica; PCC, Pectobacterium carotovora subsp. carotovora; PI, Phytophthora infestans

We proposed to measure the concentrations of ethanol, 1-propanol, 2-propanol, 1-butanol, and acetone in the commercial-scale potato storage bins located within the Potato and Vegetable Storage Research Facility at Hancock WI, and in commercial storages holding processing potatoes. Storages for processing potatoes are selected for this research because they are held at higher temperatures than those for fresh market or seed potatoes. Because of this, the incidence of rot is highest in these storages and they are likely to yield the most useful data. In parallel we will monitor the quality of the stored tubers and assess the extent of rot as the tubers are removed from storage. Our overall objective is to determine the feasibility of volatile monitoring as a tool for potato storage management that will minimize losses in storage. Recent advances in air monitoring equipment have made it possible to do this research with off the shelf rather than

custom made components. Unlike most previous studies, the sensitivity needed can be obtained from gas samples taken directly from potato storages rather than from sealed, small volume potato storage containers outfitted with chemical or cryogenic traps. These improvements will greatly facilitate the commercialization of this technology. Methods for volatile monitoring could be transferred easily to other segments of agriculture that store fresh produce.

References

1. Lui, L., et al., Discrimination of three fungal diseases of potato tubers based on volatile metabolic profiles developed using GC/MS. Potato Research, 2005. 48(1): p. 85-96.
2. de Lacy Costello, B.P.J., et al., Gas chromatography-mass spectrometry analyses of volatile organic compounds from potato tubers inoculated with Phytophthora infestans or Fusarium coeruleum. Plant Pathology, 2001. 50(4): p. 489-496.
3. Waterer, D.R. and M.K. Pritchard, Production of volatile metabolites in potatoes infected by Erwinia-carotovora var carotovora and Erwinia-carotovora var atroseptica. Canadian Journal of Plant Pathology, 1985. 7(1): p. 47-51.
4. Lui, L.H., et al., Volatile metabolic profiling for discrimination of potato tubers inoculated with dry and soft rot pathogens. American Journal of Potato Research, 2005. 82(1): p. 1-8.
5. Varns, J.L. and M.T. Glynn, Detection of diesase in stored potatoes by volatile monitoring. American Potato Journal, 1979. 56(4): p. 185-197.
6. Costello, B.P.J.D., et al., Identification of volatiles generated by potato tubers (Solanum tuberosum CV-Maris Piper) infected by Erwinia carotovora, Bacillus polymyxa and Arthrobacter sp, in Plant Pathol. 1999. p. 345-351.
7. Kushalappa, A.C., et al., Volatile fingerprinting (SPME-GC-FID) to detect and discriminate diseases of potato tubers. Plant Disease, 2002. 86(2): p. 131-137.
8. Creech, D.L., M. Workman, and M.D. Harrison, Influence of storage factors on endogenous ethylene production by potato tubers. American Potato Journal, 1973. 50(5): p. 145-150.
9. Lyew, D., et al., Changes in volatile production during an infection of potatoes by Erwinia carotovora. Food Research International, 2001. 34(9): p. 807-813.

II. Project Approach

The activities performed and accomplished during the three years of this project fall into three categories. The first was to develop a method that could be used to easily and reproducibly measure volatile compounds of interest present in the atmosphere of commercial potato storages. This work involved primarily assessing the performance of various gas chromatograph (GC) configurations to achieve the desired results. Parameters evaluated were various temperature profiles during compound elution, GC column design, and presence or absence of a trap and purge system to concentrate samples after injection into the GC. The second activity was to sample the atmosphere of commercial and research storages and to quantify the volatile compounds present. Finally, the third activity was to relate the abundance of specific compounds with tuber processing quality and with spoilage in the storage at the time of sampling and at later times.

Develop a method to quantify the abundance of volatile compounds in the atmosphere of potato storages - We established three criteria that had to be met by the method used to identify and quantify volatile compounds in the atmosphere of ventilated potato storages. First, the method had to be sensitive enough to detect each compound of interest at a concentration of 200 ppb or less. Second, all equipment had to be assembled from off-the-shelf components. Finally, sample collection in the field had to be simple and quick. These criteria were thought to be important for transitioning the method to industry. Gas chromatography is, at present, the only method that has sufficient sensitivity and resolution to meet the first two of these criteria. Sample identification used a photo ionization detector, which, unlike the more common flame ionization detector, does not require the use of potentially explosive compressed hydrogen gas. Several CG columns were

tested to determine which combinations of length, diameter, and packing material gave good separation of volatiles without requiring excessive amount of run time per sample. Columns tested included a 6 foot long 1/8 inch diameter silica gel column, a 6 foot long, 1/8 inch diameter packed HayeSep D columns, a 2 m long, 1 mm diameter 1%RT-1000 packed column, a 2 m long, 2 mm diameter 1%RT-1000 packed column, a 2 m long 0.75 mm HayesSep D packed column, and a 30 m long Rt-QS-bond 0.32 mm diameter capillary column. All columns were purchased from either SRI Instruments, Torrance, CA or Restek Corporation, Bellefonte, PA. Also evaluated was the potential benefit of using a trap and purge system to concentrate volatiles in the GC before they enter the GC column.

Sample the atmosphere of commercial and research storages and quantify the volatile compounds present - We made a commitment to minimize the time required and equipment complexity needed for sample collection in the field. Potato storages can be poorly illuminated, with slippery, uneven surfaces. Moisture and dirt are common and pose a hazard to expensive equipment. Our solution for sampling was to use airtight, glass syringes with integral valves for sample collection. In use, a syringe is filled with gas from the atmosphere near the return air of a potato storage and the valve is closed to capture the gas for later analysis. This process is easily accomplished in less than a minute. Samples can be stored for at least a week before analysis.

Samples were collected from research storages at the Hancock Agricultural Research Station and from commercial storages. The willingness of Heartland Farms and Mortenson Brothers Farms to allow access to their facilities was an essential component of this project. During the first year of this project, sampling was focused on research storages, with occasional samples removed from commercial storages as methods and expertise developed. During the last two years, the emphasis was switched so that greater attention was given to commercial storages rather than the much smaller research storages. This was done to better assess the applicability of the approach to the commercial sector. For each sample collected, observations were made on the visual appearance of the tubers, aroma of the atmosphere and evidence that the storage manager had detected a problem with spoilage and was taking corrective action, including removal of part of the potato pile.

Relate the abundance of specific compounds in the atmosphere to the activity of pathogenic organisms that cause spoilage - The volatile compounds in the air of potato storages come from many sources. Some are produced by the potatoes themselves, some are produced by microbes that live in the storage or on the potatoes but do not contribute to spoilage of the crop, and some are produced by organism that cause spoilage. The volatiles produced by this later class are expected to increase as disease is initiated or disease severity progresses. The approach used was to identify a select set of volatile compounds that have previously been associated with pathogenic rot of potatoes, and to determine if any showed an increase in abundance at the time that pathogenic rot was beginning or when the rate of spoilage was increasing. Compounds with small changes in abundance during these periods would have value as reference compounds whose abundance might be influence by, for example, rates of fresh air exchange but not pathogen activity. One goal of the project was to see if an increase in putative pathogen-associated compounds relative to reference compounds predicted the onset of rot or increased severity of rot. Thus the approach was an iterative one in which volatile compounds abundance data were collected and compared with the pattern of spoilage events. Inferences were made about which compounds might be informative. Additional data were collected that either supported or refuted a role for an individual compound as reporting pathogen activity.

III. Goals and Outcomes Achieved

The method used to quantify the abundance of volatile compounds

The method we developed for this project uses a simple GC system from SRI Instruments fitted with a TO-14 trap and purge system to rapidly concentrate gas samples on a Silica gel trap. The trap system was selected because it allows 10 ml sample volumes to be used with a relatively narrow diameter GC column. This in turn meant that samples could be run more rapidly while still achieving acceptable separation of compounds. The column that gave best performance was a 2 m long, 2 mm diameter 1%RT-1000 packed column. Total run time with our final method was less than 17 minutes per sample, which allow approximately 20 samples to be run during an 8-h workday.

The atmosphere of commercial and research storages was sampled and volatile compounds present were quantified

Seven research scale potato storage bins at the Hancock Storage research Facility were sampled approximately weekly from December 2009 to May 2010. Ten commercial bins were also sampled on more than one occasion during the spring of 2010. Based on the data from 2009-2010, we decided that greater emphasis should be placed on season-long sampling of commercial storages, since this was the approach most likely to indicate if the data collected would be useful to industry. The collection of atmospheric samples from storage bins in year two began on October 6, 2010, shorly after harvest, and ended on May 4, 2011, when all bins were more than 90% empty. Samples were collected approximately weekly. Over the course of the season we analyzed samples from a total of 17 commercial storage bins. Samples were collected for a period of two months or more from each bin. Our procedure was to begin with 10 commercial storages and follow each until they were emptied, at which time we began sampling from an additional bin. A goal for the final year of this project was to follow a larger number of commercial storages, as well as the resarch storages, throughout the entire storage season. To do this we first needed to decrease the analysis time required for each sample so that more samples could be run per day. That involved modifying the GC configureation to that described above. From October 2011 to May 2012 we collected and analyzed samples from 18 commercial storages and 6 rearch storages approximately weekly. All storages were followed from shortly after the time they were filled until they were more than 90% empty. B. Provide a comparison of actual accomplishement to the goals established for the reporting period. Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.

All of the compounds listed in Table 1 were identified in both commercial and research potato storages. Ethanol and acetone were found in virtually all samples. 1-Propanol, 2-propanol and 1-butanol were not always present, but were observed on numerous occasions. Additional compounds observed in multiple samples included ethylene, acetaldehyde, ethyl acetate and 2-butanone. At least 6 other compounds gave reproducible peaks on chromatograms, but their identity is not yet known.

Specific compounds in the atmosphere of potato storages produced by pathogenic organisms that cause spoilage The volatiles that seemed to be the best markers for pathogen activity were ethylene, acetone, 1-propanol and 2-propanol. The abundance of these compounds often increased in storage bins that were developing problems with rot. The following observations were made based on data collected in one region over three years. It is likely they will be refined or corrected as additional data are collected. Ethylene was always observed at very low

concentrations in commercial settings (less than 100 ppb). At this concentration, ethylene is unlikely to have an effect on fried product color but likely to increase tuber respiration rates. Ethylene was most informative as a predictor of disease development when it was observed shortly after bins were filled. This most likely reflected harvest damage of tubers and increased opportunity for pathogen infection. Ethylene at later times was less informative as a predictor of disease, but rather reported late stages of decay. Changes in atmospheric ethanol were only rarely associated with subsequent disease development. In most cases, ethanol served a better role as a reference compound – one that is likely made by the potatoes. In a well managed storage, ethanol content in the atmosphere tended to slowly decline as the storage season progressed (See for example Figures 2 and 3). Acetone was always present, but a rapid increase in acetone seemed to be a good marker for increased disease activity that in some cases was observed prior to a change in visual appearance of the potatoes or aroma in the storage(See for example Figure 1B). On a few occasions, extremely high amounts of acetone, more than 10 times that in a healthy storage, were observed. These very high amounts often persisted for weeks and were not associated with damaging rot. As such, we propose that they might have been produced by nonpathogenic organisms living on the tuber surface. 1-Propanol and 2-propanol were not always observed, but an increase in the abundance of either and especially 1-propanol, was often associated with disease activity (See for example Figures 1A and 1B). 2-Butanone and 1-butanol were rarely informative as changes in abundance did not correlate well with observed of disease severity or disease onset.

An initial goal of this project was to determine if volatiles in the atmosphere of a potato storage caused changes in tuber processing quality. It became clear early on that acceptable processing quality was maintained in commercial potato storages that had a wide range of volatile compounds in the atmosphere. Thus, we did not find evidence for a relationship between the abundance of those compounds that we measured and processing quality. Because of this, most effort in this project has been directed at relationships between pathogen activity and volatiles in the atmosphere.

One of the concerns we had when initiating this project was how variation in the amount of fresh air introduced into the storages would impact the data. Storage managers bring in fresh air to reduce atmospheric carbon dioxide concentration, and to combat rot when pathogen activity increases. In our sampling data, the patterns of observed volatile compounds tended to be similar from week to week for any given storage bin despite changes in ventilation rates. Because of this, we have increased confidence that this monitoring method would not require storage managers to change their best practices for it to be successful.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

As described above, the goals established for this project have been substantially met. We developed a method based on gas chromatography that can be used to measure volatile compounds in the atmosphere of potato storages. This method identified the five compounds of interest proposed in the project plan, as well as several others. We have collected samples of the atmosphere of research and commercial potato storages, as proposed, with an increasing number of samples each year. During the last year of the project we collected and analyzed over 470 samples. As the project developed, the emphasis shifted to more consistent sampling out of a larger number of commercial storages. We have identified compounds in the storage

atmosphere that have potential as markers for the onset or development of pathogenic rot. Additional experience with this approach will determine if these relationships are robust, and if volatile monitoring provides valuable information to those who manage potato storage.

IV. Beneficiaries

This proof of concept project has several realized and potential beneficiaries. These include potato growers who store part of their crop. They have benefited from having the utility of this volatile monitoring approach assessed under commercial conditions. They may also benefit in the future if implementation of volatile monitoring reduces storage losses. Additional beneficiaries are members of the potato research community who have an interest in the dynamics of pathogen activity within potato storages. Potential beneficiaries also include crop consulting firms or disease diagnostic laboratories who might be well positioned to implement volatile monitoring as a service offered to their customers.

V. Lessons Learned

The current methods to detect disease in potato storages depend on visual and olfactory assessments made by experienced personnel. These rudimentary methods work well in practice. Volatile monitoring techniques are unlikely to supplant existing methods, but may add unbiased data to the decision making process. In some cases this data may have predictive value, and in other it will be largely confirmatory.

Just as each crop year is different, each storage year differs in term of when spoilage occurs, how extensive it is, and what organisms are primarily responsible. Because of this, multiple years are required to establish a working knowledge of how to interpret changes in the abundance of individual compounds in the storage atmosphere.

It is unlikely that any single compound will be a perfect predictor of disease activity. Two or more compounds may prove to be more informative than one. Experience will still be important in assessing the likelihood that an observed change reflects a real concern or a false signal.

Disease develops quickly because of the exponential growth of microorganisms. Weekly monitoring may not be sufficient to capture the early stages of disease. Continuous monitoring, perhaps focused on a few select compounds, may have significant advantages for disease prediction.

VI. Additional Information

The research conducted as part of this project was presented at the 2012 Wisconsin's Annual Potato Meeting in Stevens Point and at the 2012 Potato Association of America Annual meeting in Denver, CO. An abstract from the Potato Association meeting will be published in the American Journal of Potato Research in spring 2013. Industry interest in this approach continues, and additional work is being carried out with funding from the US Potato Board.

Example data

The relative abundance of acetone, ethanol and 1-propanol in two research storages during the 2011-2012 storage period is shown in Figure 1. The storage in (1A) remained largely disease free

through January, but developed significant problems with disease during the February-March timeframe. A spike in 1-propanol amount occurred at the onset of disease development. The storage in (1B) developed sever problems with rot in December and was emptied at the end of the year to prevent a complete loss. Note that both acetone and 1-propanol show a rapid increase in abundance at the end of November, suggesting that they may be reporting the early phases of disease formation.

Data from example commercial storage bins are shown in Figures 2 and Figure 3. The data presented in Figure 2 come from a bin that had very low disease pressure throughout the storage season. In this case the concentration of atmospheric acetone remained low for many months. Ethanol behaves as expected, and slowly declines with time.

The data from Figure 3 come from a storage that had repeated problems with pathogen activity that began early and persisted until the bin was emptied. In this case, atmospheric acetone increased dramatically shortly after harvest and remained high for a month. The drop in acetone content that occurred in mid November corresponded to removal of diseased tubers from the pile. That action was not sufficient to bring acetone levels down to those found in a storage with little disease pressure, most likely because other foci of disease activity remained.

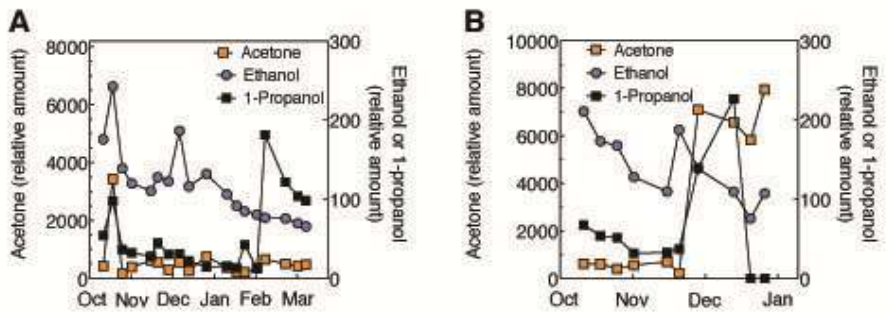

Figure 1. Volatile compounds in research scale potato storages

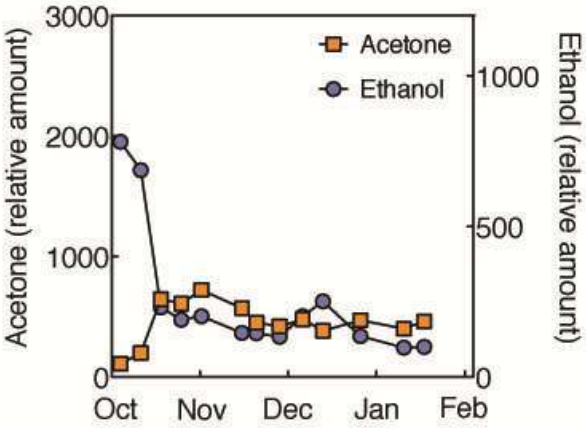

Figure 2. Volatile compounds in a commercial storage with low disease pressure.

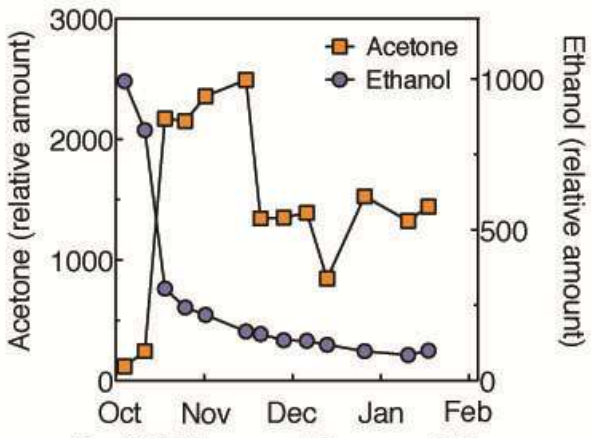

Figure 3. Volatile compounds in a commercial storage with high disease pressure.

VII. Detailed Financial Reports

$20,638.25 was spent in salary and fringe for student research staff and field workers
$7176.75 was spent for field and lab supplies

Total: $27,815

VIII. Contact Info:

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2) University of Wisconsin – Madison Department of Entomology

Project Title: Cultural Control Practices to Accelerate Adoption of Sustainable insect IPM in Wisconsin and upper Midwest Processing Pea Production (FY09FB-002)

Total Amount Received: $50,000

Date of Award: December 1, 2009

Project Contact: Eileen Cullen

Report Date: November 30, 2012

I. Project Summary

Processing pea production and harvest technology in the Midwest, where one third of the total U.S. crop is produced, presents growers and processors with insect contaminant issues. Although some insects cause no direct yield loss, contamination during harvest poses quality issues that can result in processor rejection. The purpose of this project was to investigate the putative influence of harvester technology on insect contamination in the pea crop. Current harvester heads used for pea harvest in Wisconsin, the Upper Midwest, and nationally sweep the soil surface gathering up vine and pod material that are fed into the harvester combine for separation of peas from the pods and vines.

The specific hypothesis advanced by members of the Midwest Food Processors Association (MWFPA) to University of Wisconsin Entomology Department was the assumption that this sweeping action at the front of the pea harvester creates a vacuum suction effect resulting in insect contaminants from the soil surface and lower pea canopy ending up at the grading station, processing plant, or potentially frozen or canned product. Candidate insect contaminants include cabbage looper (Trichoplusia ni) and celery looper (Anagrapha falcifera) pupae (cocoons), various stink bug species, and Colorado potato beetle (Leptinotarsa decemlineata).

Colorado potato beetle (CPB) underscores the timeliness of this project on pea head harvesting mechanical modification because adults overwinter near fields planted to processing peas and growers treat with insecticide to “knock back” CPB to prevent beetles from entering the load through the pea head. Additionally, increased insecticide for CPB puts selective pressure for resistance, as CPB has demonstrated resistance to soil and foliar-applied neonicotinoids applied in potatoes where it is a key economic yield pest.

Motivation for this project came first from MWFPA members coming to University of Wisconsin Entomology with the idea to attempt to modify the current standard pea harvester head to minimize vacuum/suction action during the harvesting process. This novel approach of harvest modification would be an example of cultural/mechanical pest control to change the harvest method so that fewer insects are taken into the combine as contaminant. Proposed long-

term outcomes and impacts of the project were predicated upon pea harvester head modification (i.e., reduction of vacuum effect during harvest). Pea varietal selection and insecticide treatment factors were also planned in field trials pending successful modification of the pea harvester head.

II. Project Approach

We formed a new working group to address the pea harvester head modification objective. The partnership included UW Entomology, MWFPA members (Del Monte Foods) and OXBO International, a local manufacturer of pea harvester head equipment in Clear Lake, WI. This was a unique partnership in that UW Entomology lacks expertise or capacity to modify harvest equipment for cultural/mechanical pest control IPM purposes. OXBO International (Brian Maul) made significant contributions to the project particularly in analyzing air flow and vacuum pressure in the standard and modified pea heads. MWFPA/Del Monte Foods led pea head modification design efforts and provided field demonstration trials on grower field plots.

[2010]: The project team (MWFAP, Del Monte Foods, Oxbo Int'l) drafted design for the modified pea harvester head to lift the pea vine from the soil surface without sweeping motion or suction force. UW Entomology coordinated efforts and recorded project plans regarding equipment manufacturing. The modified 2440 pea head was used in field trials April 12, 2010 in Texas pea fields grown for MWFPA to test the concept prior to Wisconsin pea harvest. Observations from the spring 2010 trial found that the initial conveying drum roller design was not going to be effective in bringing plant material from the sickle bar to help move material to the conveyors into the pea harvester. After the preliminary trial in Texas, a reel was mounted directly above the sickle bar to improve movement of plant material to the conveyor. Oxbo then constructed a field scale pea head with sickle bar cutting and a conveying roller to trial in Plover, WI.

Replicated research plots (peas) were planted in Plover, WI to test two different pea varieties (DMC55-89 and SEM1470) for response to pea harvester head. Response variables were to be measured as relative Colorado potato beetle (CPB) contaminant level between varieties after harvest with the modified pea head. The modified pea head was intended to move/shake the pea canopy to dislodge insects from foliage before the sickle bar contacted the vine and the picking roller contacted incoming vines to strip pods. June 30, 2010 we began by harvesting the Plover, WI pea plots with little to no insect contaminants or other debris to show proof of concept. After a few 10 ft. passed, it was evident that we needed to adjust the relationship between picking reel and sickle bar. Reel mounting arms were modified to allow the reel to move closer to the sickle bar cutter. A sequence of running the harvester head was repeated until the plots were depleted. Several issues were identified for improvement on the pea head before insect contaminant data could be obtained. For example, the weight of the header was too heavy, vines built up between the modified roller to sickle bar distance, reel revolved too slowly, plastic reel fingers were too week and bent over when contacting vines rather than lifting and shaking the vines. The team could not obtain appropriate data collection on test plots as the first modified pea head needed additional work. Figures and project findings are detailed in our Semi-annual report for July - December, 2010.

Project focus shifted to better understand the mechanism of the problem of contaminants entering the harvested material through the pea head.

[2011-2012]: OXBO collected air pressure measurements within three different pea head models for comparison to determine if and how much vacuum pressure is exerted at ground and vine level to "suck" insect and other contaminants into the picking reel and conveyor. A new hypothesis motivated this work. That is, rather than suction pressure created by the pea head, it may be a function of vine momentum moving into the conveyor through the picking reel that pushes contaminants into the conveyor. Additionally, Del Monte Foods cooperators worked on a "bug knocker" brush to be mounted on the pea head to dislodge insects before they entered the conveyor.

Final project results were detailed in our last semi-annual report submitted December 2011. Our project hypothesis for this grant was that current pea head models in the industry create a vacuum, suction air flow action that causes intake of insect contaminants into harvested pea load. Pea head prototype development and test runs in years 1 and 2 of this project discovered that vacuum air flow, in fact, is not a factor. This was an unexpected and important discovery and was unknown prior to this project. This new knowledge allows us to better understand the contribution of other mechanisms of the pea head to insect contaminants, and how to manipulate these mechanisms to mitigate insect contaminants in harvested peas.

III. Goals and Outcomes Achieved

Insecticide Use-
Baseline 2008 and 2009: lbs. active ingredient (pyrethroid) per field per season, 2 year average.
Target 2010: 3-5% reduction in pyrethroid use in on-farm trials
Target 2011: 5-15% reduction in pyrethroid use in on-farm trials
Target 2013: 25%+ reduction in pyrethroid use in on-farm trials

(Performance Measure) Obtain pyrethroid insecticide application records on peas from state and regional processing companies receiving Wisconsin peas (i.e., Seneca, Del Monte, Hartung Brothers, etc.). Telephone interview assessments with processing company field managers and contracted growers to be conducted by PI, E. Cullen. Data will be consolidated and averaged to establish 2008-09 benchmarks against which project results will be measured. No individual company data identity will be revealed.

A baseline data comparison of insecticide use pre- and post- project was not feasible in the end because we were not able to implement the field trials as planned.

Insect Contaminants-
Baseline 2008 and 2009: % insect contaminants per field per season, 2 year average.
Target 2010: initial reduction (%) in insect contamination in on-farm trials
Target 2011: continued reduction (%) in insect contamination in on-farm trials
Target 2012: sustained reduction (%) in insect contamination in on-farm trials

(Performance Measure) Obtain grading station scores for pea loads processed from on-farm trials. UW-Extension/UW-Madison Entomology, growers and Midwest Food Processors Association, Inc. will cooperate to provide representative 2008-09 data as industry benchmark. No individual company data identity will be revealed.

Performance Monitoring Plan: Data sources will include processing company managers and

growers (insecticide use record and insect contaminant benchmark data). UW-Extension and Midwest Food Processors Association have existing relationships with Wisconsin pea growers that make our project team uniquely suited to obtain these performance indicator data. Industry benchmark data will be collected via telephone and face to face personal conversations/informal questionnaire interviews. Field data will be gathered through on-farm plot work (insect sampling from pea canopy before harvester strip trials and at grading station). Field data will be collected by Dr. Cullen, assisted by student hourlies, and in cooperation with growers and processing company personnel running the harvest treatment operations at each on-farm demonstration site.

Project activities were devoted to improving understanding and application of processing pea production harvest technology. Our objective was to create and implement a modified pea head to reduce insect contaminant load into the harvested product, thereby reducing insecticide use for insect contaminants. This project examined a hypothesis by members of the Midwest Food Processors Association (MWFPA) that a vacuum effect is created by the sweeping motion of the pea head harvester. By collaborating with Oxbo International, pea harvester manufacturing company, we were able to test this hypothesis.

Project activities focused first on preliminary field demonstration trials with modified pea harvester head design with additions and enhancements to the picking head component of pea harvesters. The initial modifications to the pea head were not sufficient to run planned field trials. The project focus was revised in previous reports to analyze airflow, vacuum and material flow characteristics of Oxbo's two pea harvesting head designs, the 156/4040 and 4159.

We underestimated the amount of time and detail required to tease apart what is happening at the pea harvester head-plant canopy interface, particularly within the pea head itself and how that affects insect contaminant uptake. Therefore, we were not able to conduct replicated and quantifiable field demonstrations trialing the standard vs. modified pea head and collect corresponding insect contaminant data. The majority of project time and effort was directed to teasing apart the causative factor within the pea head leading to insect contaminants. **Our significant finding is that insect contamination is not due to air flow vacuum effect so this original hypothesis was proven false by this project.** Thanks to this project, we now know that focus for reduced insect contamination should be placed on picking reels, shakers, and belts to dislodge insect contaminants from the canopy prior to harvester uptake are necessary. We will continue to seek additional funding to research these concepts.

Please see attached report entitled *Pea harvestor head test final results* for additional information.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

See above for details. Please see attached report entitled *Pea harvestor head test final results* for additional information.

IV. Beneficiaries

Potential economic impact of the project is unknown at this time, but longer term beneficiaries include processing crops companies, farmers who grow pea crops for processing crop contracts, and equipment manufacturers throughout the country. There are approximately 400 Wisconsin pea farmers, 2000 Midwestern pea farmers and 3500 pea farmers nationally who will likely benefit from the research done in this project. Because the majority of project time needed to be devoted to determining or ruling out factors involved in pea harvester head contribution to insect contaminants, there was not sufficient time to proceed to initially planned field studies and collection of pre- and post-baseline data with regard to insect contaminant and insecticide use. The largest benefit of this project to processing pea crop stakeholders is the fact that we have demonstrated that vacuum airflow does not contribute to insect contaminants. This has narrowed the scope of causes of insect contamination and paves the way for future research on equipment and procedure modifications for less insect contaminants.

Please see attached final report for results.

V. Lessons Learned

MWFPA (Del Monte Foods) partner was not successful in collecting quantitative data during the project. Our project goals proved ambitious given how little was known about the mechanism of pea head air flow and vacuum pressure. OXBO's contributions to this project are significant. Although in the end, the knowledge gained is more basic than applied, this is an important first step to have found that vacuum suction is not a factor in insect contaminants. That was the previous industry assumption. My assessment is that MWFPA and Del Monte Foods project partners were overly ambitious in that they did not realize the challenges of modifying the pea head before understanding air flow mechanics within the head unit. Knowledge gains from this project, particulaly OXBO's work, lay the foundation for future work modifying the pea head based on mechanical adjustments.

VI. Additional Information

Please see attached final report document

VII. Detailed Financial Reports

$45,000 subcontract services to OXBO International project partner for pea harvester head modification design, labor, field trial trouble-shooting, and internal airflow measurement analysis, testing and report. (Installments of $15,000 per year).

$3,400 in research parts to modify pea head, paid to project partner Del Monte (MWFPA representative on the project) for their contributions to attempted modified pea head prototype.

$1,600 services payment to pea growers for providing ground to plant plots and trial modified pea head for proof of concept.

Total: $50,000

VIII. Contact Info:

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3) Wisconsin Muck Growers Association

Project Title: Epidemiology of the astor yellows phytoplasma: factors affecting the spread and distribution of the pathogen in affected muck crops. (FY09FB-003)

Total Amount Received: $50,000

Date of Award: December 1, 2009

Project Contact(s): Russel Groves

Report Date: November 22, 2011

I. Project Summary

A critical factor for a successful disease control program relies on a detailed understanding of the components which directly affect disease development. Knowledge of the organism you are targeting, environmental influence on disease development, and host plant susceptibility are vital to timing and scheduling chemical applications for control of aster yellows. Improved timing of pesticide applications as a result of the aster yellows index that target periods when plant protection is needed most will improve product efficacy and limit the number of sprays needed for pest control. In addition, the use of disease and insect monitoring strategies to assess pest or disease presence in a field may better time the initiation of pesticide programs and reduce overall management costs. Successful disease control and use of an integrated pest management approach to crop production requires thorough knowledge of the host and the disease susceptibility of the variety being grown. This aspect is a foundational building block of an integrated disease management program. Cultivars differ in disease resistance and disease develops at different rates depending upon the level of resistance. The majority of industry accepted carrot cultivars have been selected for quality traits and continue to be susceptible to aster yellows phytoplasma (AYp).

Currently, the decision to intercede and implement a pest control practice (e.g. insecticide spray) is based upon calculation of the Aster Yellows Index (AYI). Control practices strictly utilize insecticide sprays (primarily Group 3 synthetic pyrethroids, IRAC, Mode-of Action Classification http://www.irac-online.org/) that target not only the aster leafhopper, but will impact all other beneficial insects present in the crop. The index has also been expanded to include covariates such as crop type (e.g. carrot, celery, etc.) and host resistance within a crop. The aster yellows index was originally developed using data obtained from leafhopper bioassays which directly measured the ability of an individual leafhopper to infect a susceptible host (Chinese aster). A major constraint associated with implementation of the bioassay to farm-scale management practices was the time needed for symptom development of infected plants. Currently, crop scouting and molecular diagnostic tools incorporating polymerase chain reaction (PCR) have been adopted to determine the percentage of leafhoppers that are infected with AYp.

These molecular diagnostic tools have decreased the inherent lag between finding AYp- infected leafhoppers and prescribed sprays. However, AYp-infected leafhoppers do not always transmit the AYP to susceptible crops so there is not a direct relationship between the proportion of infected leafhoppers and the proportion of infective leafhoppers. In fact, the number of infected insects is usually somewhat higher than the number of infective insects. The discrepancy between infected and infective insects leads to an error in the calculation of the aster yellows index which biases the spray decision, in most cases, towards unnecessary applications.

The synthetic pyrethroids are a class of chemicals that have been introduced over the past three decades for a variety of insecticidal uses including both agricultural and domestic applications. These materials currently comprise the backbone of low-cost registrations which are relied upon for use against the aster leafhopper in support of the AYI. The synthetic pyrethroids were conditionally registered beginning in 1984 for use on selected crops and currently, EPA is assessing risks to non-target organisms for ten synthetic pyrethroids: bifenthrin, cyfluthrin, cypermethrin, deltamethrin, fenpropathrin, fenvalerate, cyhalothrin, tefluthrin, tralomethrin, and permethrin. Several of these synthetic pyrethroids remain conditionally registered for use on vegetables grown in muck soils, however, each of these chemicals is highly lipophilic and in aquatic environments tend to strongly adsorb to sediments. Traditional methods for evaluating pesticide risks to aquatic species focused on ecological effects from exposure to chemicals in the water column of the aquatic environment and do not consider exposure of aquatic organisms to benthic sediments. Based on the affinity for synthetic pyrethroids to partition to sediments, EPA identified the need to re-evaluate the environmental fate and potential toxicity of synthetic pyrethroids in aquatic sediments, especially in ecologically sensitive areas including low-land muck soils. Most recently, some states have placed certain pesticide products containing pyrethroids into re-evaluation in 2006. The re-evaluation is based on recent monitoring surveys and toxicity studies revealing the widespread presence of synthetic pyrethroid residues in the sediment of both agricultural and urban dominated waterways. Under section 4 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), US EPA continues to re-evaluate existing pesticides to ensure that they meet current scientific and regulatory standards. US EPA has recently completed several Reregistration Eligibility Decisions (RED) for the synthetic pyrethroid group is insecticides and will continue to do so in the future under section 4(g)(2)(A) of FIFRA. These compounds are broadly characterized as having a wide spectrum of activity often with acute oral neurotoxicity to mammals, notable chronic effects as endocrine disruptors, and are classified as both mutagenic and carcinogenic. With the advent of novel, reduced risk, and less broad spectrum registrations for many homopterous, sucking insect pests (e.g. spiromesifen (Oberon), spirotetramat (Movento), neonicotinoids (several registrations), the continued RED eligibility of this important class of insecticides could be in jeopardy.

Taken together, it is important to generate new, more research-based and sustainable forms of pest management approaches to manage this vector-borne disease now and into the future. The primary focus of this research is to improve our knowledge of where leafhoppers acquire the pathogen, when they move into susceptible fields, and when they spread the pathogen to crops towards the development of long-term, sustainable management programs into the future.

II. Project Approach

Strains of AYp appear to have a complex pathogenic relationship with a diverse host range including members of both monocots and dicots. Analyses of the genetic diversity of AYp have begun to elucidate differences between many of the AYp strains. While not explicitly studied in the Midwest agroecosystem, a conclusion emerging from studies of insect-vectored pathogen systems, is that the pathogen strains cluster within groups based upon host association. In turn, we collected disease phenotypes with varying symptomology in selected field locations including affected vegetable crops (e.g. carrot, onion, and potato) as well as cereal crops. Detailed records were kept from diseased plant surveys to document the occurrence of AYp infection and the letter characterization of the pathogen. A total of 30 symptomatic plants of each crop plant and cover crop species (carrot, onion, potato, barley, and wheat) were collected from among 7 locations in the state over the two years of the proposed study (2010 and 2011). Experimental sites were located in Palmyra, WI at Dean Kincaid Farms and also in Endeavor, WI at Gumz Muck Farms, LLC and finally Shiprock Farms, Friendship, WI.

**Although barley and wheat were looked at in conjunction with this project, no funds were used for data collection or other activities within a field or row crop context. We did notice that 'potentially symptomatic' plants of both wheat and barley were observed at vegetable producing locations, we did not expend funds or effort associated in this grant to explore this option. In the future, we may explore this option, but to date we have not pursued any research in this direction.

Phytoplasma strains were initially characterized and identified by total nucleic acid extractions, according to Lee et al. (1993a), from original natural host plants determined to be infected with AYp. To obtain nearly full-length copies of the 16S rDNA genomic region, a nested polymerase chain reaction (PCR) using 2 sets of primer pairs was used to amplify a specified DNA fragment (P1/P7 & F1/rpR1) and resulted in target PCR products. For PCR amplification, 38 cycles are conducted in an automated thermal cycler (MJ Research DNA Thermal Cycler PTC-200) with AmpliTaq Gold polymerase. Reaction conditions used are consistent with Marcone et al. 2000. Cloning of PCR products and sequencing of DNA fragments of the 16S rRNA genes followed initial PCR. PCR products were purified using a Qiaquick PCR Purification kit and cloned in Escherichia coli by using a TOPO TA cloning kit (Invitrogen), according to the manufacturers' instructions. Sequencing was performed with an automated DNA sequencer (ABI Prism) available in the UW Biotechnology Center, UW-Madison.

The seasonal migration patterns and infectivity of aster leafhoppers were also compared and contrasted to local populations of the insect that overwinter within Wisconsin. In the spring interval (Apr 15 – May 1) of each year in the study, we made collections of aster leafhopper along their annual migration routes extending from northern Louisiana to localities in the upper Midwest including Wisconsin. Specifically, we conducted leafhopper surveys of early spring grain crops along a north-to-south gradient during this 2 week period. Experimental sample locations included: 1) southern Arkansas (Fulton, AR), 2) northwest Arkansas (University of Arkansas, Virology/Nematology Experiment Farm, Fayetteville, AR), 3) central Missouri (University Missouri, Columbia Experiment Station, Columbia, MO), 4) south central Iowa (Allied Gas and Chemical, LLC, Oskaloosa, IA), 5) southern Wisconsin (Arlington Agricultural Experiment Station, Arlington, WI) and 6) southern Minnesota (Del Monte Foods, Sleepy Eye, MN). At each site, early season grain crops were swept with standard 15" sweep nets to collect migrating adult aster leafhoppers along their annual migration route. Insects collected were held in 95% EtOH for later analysis and for the detection of AYp.

Detection of AYp in Insects. The presence of AYp in a subsample of vectors captured on sweep net samples, yellow cards, and on perennial and non-crop species during the spring migration surveys and outside the fields in non-crop hosts were also determined using PCR (previously described). Based on genomic information, strain specific primers were used to investigate the pathotype profile present in these populations. Here also, were quantified the AYp in selected insect vectors to identify the relationship between real-time PCR cycle and transmission likelihood. Specifically, determined the probability that an AYp-infected aster leafhopper will be infective by elucidating the dose-response relationship between leafhopper AYp-titer and leafhopper infectivity and predict the infectivity of aster leafhopper field populations through the utilization of the dose-response relationship. AYp DNA from insects was quantified using qR-PCR and expressed as genome units/ng of host DNA and ng/insect. Two AYp genes were used as targets for R-PCR 1) the elongation factor TU (tuf) (AJ271323) and 2) (NC007716). Both genes are present as single copies in the AYp genome. The leafhopper (M. quadrilineatus) CP6 wingless gene was used as the target for amplification of insect DNA, which was used as a reference gene. Primers will be designed using Beacon Designer (PREMIER Biosoft International).

III. Goals and Outcomes Achieved

Developing a comprehensive, sustainable IPM-based program for AYp management has been a primary goal of the research. Each year, Wisconsin muck producers grow carrots on an average of 3,200 acres, onions on 2,200acres, and potatoes on approximately 1,800acres grossing over $14 million dollars in revenues (USDA-NASS, 2007 annual bulletin). Unfortunately, these muck crops are threatened annually by the occurrence of AYp which is obligately transmitted by the aster leafhopper. Current control practices strictly utilize restricted-use, broad spectrum insecticide sprays that target only the insect vector and impact numerous non-target, beneficial insects in these crops, which serves as our benchmark. A primary goal of this research has been to improve our knowledge of where leafhoppers acquire the pathogen, when they move into susceptible fields, and when they spread the pathogen to crops. In total, we have collected disease phenotypes with varying symptomology in selected vegetable and cereal crops and attempted to develop durable diagnostic methods for characterization of unique pathotypes present in the upper Midwest. Additionally, we have successfully quantified the unique transmission rates of the select pathotypes by ALH to susceptible crops and incorporate different regional populations of ALH to detect genetic variations in insects associated with vector competence. By completion of these objectives, we have helped to reduce the exclusive reliance on insecticides by 1-2 sprays per year, which will serve as our target, by determining which AYp strain(s) is responsible for disease development in the crop and more accurately defining the need to spray for control of the insect vector.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Refinement of the Prescriptive Aster Yellows Index. A final goal of the proposed research has been the development of a more comprehensive crop management plan to include greater detail in AYI prescriptive treatments that will reduce the potential for disease development in susceptible crops. AYp has typically been controlled in Wisconsin through repetitive applications of contact insecticides, such as permethrin, lambda-cyhalothrin, endosulfan, cyfluthrin, and most recently, bifenthrin being the predominant choice of growers. Once insect populations have initially reached threshold levels, along with detection of AYp, prescriptive

insecticides are commonly applied on a 7-10 day calendar schedule. In part, the rationale behind these repetitive spray applications results from the fact that a single insecticide application may cost only $1.5 to $3.0 per acre, not including cost of application. Although the number of insecticide applications may fluctuate annually, depending upon the timing when the AYI is initially exceeded, it is possible for as many as 5-7 re-applications to occur on the same crop. As noted earlier in the proposal, AYp-infected leafhoppers do not always transmit the pathogen to susceptible crops so there is not a direct relationship between the proportion of infected leafhoppers and the proportion of leafhoppers which will transmit the pathogen. In fact, the number of infected insects is usually quite high compared to the actual number of individuals that will transmit. The discrepancy between infected and 'potentially inoculative' insects is very important and can lead to errors in the calculation of the AYI which biases the spray decision, in most cases, towards unnecessary applications.

A very important outcome of this AYI refinement has been the verification of infectivity estimates gained from the field through real-time PCR methods currently employed. Insect populations from the field were swept up and placed on rye plants until for transport back to the greenhouse. Single leafhoppers were clipped to healthy individual carrot plants (at growth stage) and given a 24 hour access period. Each leafhopper was assigned a number according to its plant number. After 24 hours, leafhoppers were removed from carrot plants, placed in 1.5 ml microfuge tubes, and stored at -80C until AYp-quantification. Carrot plants will be moved to a greenhouse, sprayed with insecticide and grown out for 40 days. Disease (0 = no disease, 1 = diseased) was assessed visually on individual carrot plants at 10, 20, and 30 days post inoculation (dpi). At 30 dpi, young carrot petioles were collected, flash frozen and stored at –80C until DNA extraction. Individual insects were assayed for AYp using the method described above. Predictions of disease incidence were calculated using the greenhouse estimated values for λ and τ, the parameters describing the distribution of AYp-titer in insects μ and σ, and the percentage of infected insects.

$$\text{Incidence} = \%\ \text{infected insects} * \Phi(\mu - \lambda / \sqrt{(\sigma 2 + \tau 2)})$$

Incidence predictions were compared to the true incidence that occurs in the bioassay. Effectively, this approach established a benchmark against which we can compare to actual numbers of inoculative individuals in a population. There are four significant new pieces of information that we learned, or outcomes from these two validation experiments. I) The amount of AYp in insect can be quantified (titer) and the distribution of titer among infected leafhoppers can be determined. II) The AYp growth rate in insect was determined andfit to a logistic growth model. III) The relationship between the amount of AYp in an insect and an insect's ability to infect a susceptible plant was explicitly quantified. IIII) The predictive value of the dose-response model was evaluated using field sampled insects. The flexibility associated with these methods has allowed the determination of leafhopper transmission efficiency (as quantified by the dose-response relationship) corresponding to environmental variation or AYp-genetic variation. Results from these experiments has now produced significant, new information about the AYp in its leafhopper vector and has provided a better understanding of the importance of in-vector AYp-variability in relation to the distribution and spread of AYp in the carrot agroecosystem.

IV. Beneficiaries

The proposed project was supported by the Wisconsin Muck Farmers Association of Wisconsin, the Wisconsin Carrot Growers Association and Cooperative, the Wisconsin Onion Growers Association, and administered through the Wisconsin Potato and Vegetable Growers Association. As noted throughout the proposal, Wisconsin muck grown vegetable crops are threatened annually by the aster leafhopper, which has emerged as the dominant insect pest due to its ability to transmit the AYp. Currently, disease control is achieved through sequential insecticidal sprays that target populations of the aster leafhopper within the susceptible crop. A more comprehensive and sustainable management approach to limit AYP now requires a diversified control strategy and the proposed goals and outcomes outlined herein have directly benefitted the Wisconsin Muck Farmers and the other allied muck grown crop industries.

V. Lessons Learned

This project was directed at further enhancing our present understanding of the epidemiology of AYp in the upper Midwest region of US with a focus on factors that influence its geographical distribution and spread. In total, this information may further be useful in understanding the epidemiology of other economically important diseases caused by other Candidatus phytoplasma spp. By completion of these objectives we will also provide accurate, new information about the relative importance of annual introduction of AYp strains versus the resident population structure. The results of these studies are anticipated to benefit agricultural producers, crop consultants and other stakeholders and will be essential for properly timing vector control measures and developing cultural practices that decrease the accumulation and persistence of the pathogen near our susceptible croplands. Given the uncertainty of the Group 3 insecticides (synthetic pyrethroids) and future re-registration eligibility decisions from EPA, the outcomes of this research will help in devising complementary, sustainable approaches to managing the aster yellows disease through a combination of well-timed chemical and non-chemical tactics.

VI. Additional Information

Vegetable Entomology Web-Page, Research Sections:
http://www.entomology.wisc.edu/vegento/research/index.html

Presentations

Frost, K. and Groves, R.L. 2009. Midwest Food Processors Association. "Seasonal infectivity of aster leafhoppers in carrot." December 10, Green Bay, WI.

Frost, K. and Groves, R.L., 2009. "Seasonal infectivity of aster leafhoppers in carrot." February 3, Stevens Point, WI.

Publications

D.L. Knuteson, W.R. Stevenson, J.A. Wyman, A.J. Bussan, J.B. Colquhoun, C.A.M. Laboski, R.L. Groves. 2009. A3843. BioIPM Carrot Manual. University of Wisconsin Cooperative Extension.

P.M. Rogers, W.R. Stevenson, J.A. Wyman, K. Frost, and R.L. Groves. 2011. A3953. IPM Perspectives for Carrot Foliar Diseases in Wisconsin. University of Wisconsin Cooperative Extension.

K. E. Frost, D. K. Willis and R. L. Groves. 2011. Detection and variability of aster yellows phytoplasma (Candidatus Phytoplasma asteris) titer in its insect vector, Macrosteles

quadrilineatus. J. Econ. Entomol. 104(6).

VII. Detailed Financial Reports

Salaries, Wages & Fringe Benefits *List information on position title, salary, fringe benefits, duration, etc.* **$34,008 salary and $9525 fringe**		Approved Grant Budget	Actual Grant Expenses
		$34,008	$38,991.34
		$9525	$10,952.91
	Total	$43,533	49,944.25

Supplies & Materials *Itemize by large categories if possible* Field lab supplies		Approved Grant Budget	Actual Grant Expenses
		$6467	$55.75
	Total	$6467	$55.75

*Note that far less was spent on supplies than originally thought and labor for the project exceeded expectations but since the difference was below 20% of the grant total, we did not submit for official budget change approval. We did have discussions with Julie Speck, the DATCP Grants Manager about the changes prior to spending the funds.

VIII. Contact Info:

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4) Wisconsin Potato and Vegetable Growers Association

Project Title: Potato systems for improved management efficiency and improved raw product quality

Total Amount Received: $75,000

Date of Award: December 1, 2009

Project Contact(s): Duane Maatz

Report Date: January 6, 2012

I. Project Summary

Potatoes are one of the largest specialty crop industries in Wisconsin being grown on 65,000 acres with an annual harvest of more than 26 million cwt and an annual value of more than $250 million. Farm gate value of the Wisconsin potato industry is increased by up to 5 fold through fresh packaging and marketing, processing, chipping, and seed certification. Wisconsin potato growers have been industry leaders in development of sustainable management systems as evidence by the Healthy Grown Potato program and other accomplishments. The goal of this proposal was to further improve the sustainability of the Wisconsin potato industry through improved integrated management systems and raw product quality of newly harvested and stored potatoes. This was accomplished through field research identifying new varieties with disease resistance and raw product quality, improved weed management based on potato competitiveness, management practices with slow release nitrogen fertilizers, methods for production of disease free seed, and new techniques for integrated management of early and late blight, Colorado potato beetle, and other pests. Furthermore, potatoes harvested from research trials were stored in the new potato storage research facility to quantify impacts of field management practices on quality of stored potatoes.

II. Project Approach

The overall goal was to develop improved integrated pest and nutrient management systems and improve quality of raw potatoes. This was accomplished through collaborative research with growers, UW-Madison potato team, and processors and packers. Specific goals included:

1) Develop integrated nitrogen fertility management systems with slow release fertilizers, perennial cover cropping, and lower nitrogen demanding varieties. Nitrogen management trials were conducted during summer of 2010 and 2011 by Matt Ruark. In these trials 4 different slow release fertilizer products were compared to traditional fertilizer inputs. Small plot and field scale research trials with specific focus on ESN. Lysimeters were installed in plots to evaluate movement of nitrates through the soil profile beyond the rooting zone. ESN was the only slow release nitrogen fertilizer product that yielded similar to conventional synthetic fertilizers. Yield

was optimized at total N rates 20 to 50 lb/a less than conventional fertilizers in small plot trials, but these results could not be duplicated in field scale trials. Lysimeters showed slow release fertilizers resulted in less leaching during the potato production season. ESN is not currently recommended as means for meeting potato nitrogen fertilizer needs due to costs and inconsistent effectiveness at field scale.

2) Develop integrated weed management systems based on understanding of varietal competitiveness and judicious use of herbicides. New herbicides in potato are not available, so management systems rely on existing products including metolachlor, metribuzine, and rimsulfuron. Varieties such as MegaChip, Atlantic, Superior were shown to have faster canopy development and were more tolerant of weed competition. Varieties such as Bannock were shown to have slower developing canopy and therefore require longer residual herbicide activity to manage weeds.

3) Develop enhanced integrated pest management programs for insect pests that addresses resistant potato beetles and use of lower risk products. Russ Groves tracked resistance to neonicitinoid insecticides which has increased in Wisconsin during 2010 and 2011. This has been verified as change in LD50 as well as increased range. The result is shorter duration of management of Colorado Potato Beetle with neonicitinoid insecticides. Different strategies such as imbibition of insecticide in acrylamide, application through drip irrigation, and side shanking insecticide into the hill allowed for application of insecting when Colorado potato beetle adults emerged from soil in the spring rather than at planting of the crop. The delayed application time proved effective for increased duration of Colorado potato beetle, but has short-term application as resistance levels increase. Multiple alternative insecticides were identified (primarily diamides) with excellent efficacy against beetles and are now commonly being recommended for management of beetles. Russ also conducted numerous trials to develop prediction models for aphid migration and reproduction and subsequently tested insecticidal soaps as a means for preventing spread of PVY. The model combined with proper and frequent timing of soaps was proven effective and is now recommended to all seed growers. This has greatly reduced incidence of PVY.

4) Develop enhanced integrated disease management systems based on resistant varieties and use of lower risk fungicides and clean seed. Amanda Gevens conducted research on early and late blight management and control of other plant diseases. Early blight resistance to boscalid has created new challenges for management, but new products were found in fungicide trails providing for successful management. Late blight infected potato in Wisconsin in 2010 and 2011. Amanda identified the strains infecting WI potatoes and determined that several infections occurred from tomato transplants imported into WI with late blight. Amanda now works with WI Dept of AG Trade and Consumer protection to scout transplants across the state early in the spring and summer to identify infected transplants and destroy them. Amanda also conducted trials evaluating chlorpicrin for suppression of common scab which was shown to be effective for scab management in seed potatoes. Amanda also evaluated ozone, phosphonic acid and other products for suppression of storage diseases. Phosponic acid managed fungal pathogens in storage but only when sprayed directly onto tubers being loaded into storage. Farmers are reluctant to spray water on potatoes going into storage. Ozone results have been difficult to obtain.

5) Evaluate effects of field management on storability and raw product quality of potato. AJ Bussan conducted cultural and storage trials. Cultural trials evaluated seed age and effects on productivity in 2010. Density of new varieties was evaluated in 2010 and variety specific fertility management systems investigated in 2011 and 2012. Plant density for chips must produce 140 - 160 tubers per 10 foot of row. Fresh and processed russets must produce 120 to 140 tubers per 10 foot of row to optimize size profile and yield.

Jiwan Palta bred new potatoes for marketing in Wisconsin. Nicolet, Tundra, Accumulator and Lelah are new chip potatoes. Nicolet and Accumulator are being planted on over 1,000 acres in northern and southern US, respectively. Tundra and Lelah are both being used for long term storage for chipping in Wisconsin.

6) Extend results through newsletters, Badger Common Tater, UW extension bulletins, and WI Annual Potato Meeting. Potato workbook was re-written based on results from this project. Every potato grower in Wisconsin will receive a copy. 20 newsletters were distributed to over 350 farms a year, each year of the project. An article was published every month in the *Common Tater*, the Wisconsin Potato and Vegetable Grower's monthly grower magazine. The Wisconsin Potato meeting was held in February 2010, 2011, 2012 where progress on each aspect of this project was shared.

III. Goals and Outcomes Achieved

Accomplishments by objective:

1) ESN has been shown to be an effective way to manage nitrogen in potato in small plot trials. We have also shown reduced need for supplemental N following heavy rains and potential for substantial improvement in nitrogen use efficiency. Field scale demonstration trials have not been as successful with shown reduction in yield and quality in potato following ESN compared to conventional nitrogen management practices. Research is continuing under separate funding to further improve the management and increase adoption.

2) Weed management systems specific to different varieties with shown differences in growth and development and weed competitiveness have been developed. These have been shown to growers and weed management systems have been modified specific to variety.

3) Integrated pest management systems have to be modified due to increased insecticide resistance. Colorado potato beetles have developed sufficient resistance to neo-nicotinoid insecticides that the product efficacy is now reduced. Alternative management systems that include families with alternative modes of action and lower pesticide risk have been developed. This includes management systems that rely on spinosads, rhimond, and anthrylic diamides with excellent activity. Furthermore, research on use of insecticidal soaps for aphids has dramatically reduced disease incidence in Wisconsin seed potatoes.

4) Disease management systems have been enhanced and modified since the inception of this proposal. This includes enhanced monitoring of climate for improved early and late blight management. Late blight has been identified and isolated in Wisconsin potato fields over the past several years. Management has focused on cultural control, protective management and continued diagnosis in cooperation with DATCP. Early blight has become increasingly difficult to management, but alternative protectants with proven efficacy have emerged and are being

evaluated. Early dying and common scab management options including use of chlorpicrin have been developed and evaluated at a commercial scale. Finally, storage disease including use of Phostrol and ozone have been developed or are being tested. Phostrol is proven effective, but mis-application can cause substantial crop damage. Ozone results are incomplete.

5) Research has been conducted evaluating nutrient uptake of potato with the hope of finding new lines with improved nitrogen use efficiency and lower nitrogen fertilizer requirements. In addition, we have evaluated use of different vine desiccation timings to optimize post-harvest quality of processing potatoes. Furthermore, we have studied use of irrigation post vine-kill to reduce water loss and improve quality of stored potatoes.

6) Multiple meetings, publications, and newsletter articles have been distributed throughout the industry. There have been approximately:

- 6-10 peer reviewed manuscripts
- 36 trade journal publications (primarily the Badger Common Tater)
- 70 or more newsletter articles

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Expected outcomes from the grant:

• GOAL: specialty crop research on conservation and environmental outcomes

Outcome: increased use of slow release nitrogen fertilizer products in potato production and documentation of impact on nitrate leaching. Nitrogen fertilizer use can be assessed with Wisconsin Agricultural Statistics Service (WASS) data.

-little adoption of ESN has occurred. Over 10-12 farms have tried ESN, but have observed reduced yield and quality as a result. These farms continue to try ESN and we are cooperating with them to optimize performance. Adoption will be limited until field demonstrations produce better results.

Outcome: adoption of reduced risk pest management strategies will also be tracked. Integrated management systems will be developed that utilize lower risk pesticides that can be tracked by WASS. Label recommendations for new low risk pesticides will reflect optimal use patterns and methods for preventing or delaying resistance.

-Over 80% of farms have adopted modified insect and disease management strategies based on outcomes of these efforts.

• GOAL: new and improved potato varieties

Outcome: adoption of new potato varieties with resistance or tolerance to key disease, improved quality, and lower nitrogen fertilizer demand (i.e. Bannock Russet, Premier Russet, MegaChip, W2133, and others). Seed certification data will provide information on adoption of new varieties by Wisconsin and other Midwest Growers.

-MegaChip seed was certified on 400 acres. MegaChip has less need for N and improved tolerance to early dying. This represents 6,000 acres of commercial production with about half of these acres occurring in Wisconsin.

-Nicolet, Accumulator, Tundra and Lamoka are under commercial trials. All have increased productivity and recovery decreasing need for acres to meet supply demands. Total acres of certified seed is nearly 100 acres which would be 1,500 acres of commercial production. This might increase 10 fold in the next 2 to 3 years.

• GOAL pest and disease control
Outcome: Shifts in best management strategies will be recorded specifically as it relates to insecticide, fungicides and herbicide use and adoption of resistant varies. Adoption of new practices into Healthy Grown Program will allow for use of certification data to summarize IPM adoption, new varieties, and other data by Healthy Grown and other growers.
-BioIPM workbook is being modified to represent specific changes in recommendations to manage potato pests.

• GOAL: sustainability
Outcome: The core purpose of this proposal addresses the economic, environmental, and social sustainability of the Wisconsin potato industry. Maintenance of current acreage and productivity will be seen as success. Growth in the production of specialty potatoes or potato products will indicate additional successes and areas for potential industry expansion.
- potato acreage in Wisconsin has remained at or near 60,000 acres.
- average price has been competitive with other potato production regions across the country.

IV. Beneficiaries

Nearly all Wisconsin potato farms, processors, and allied industries benefit. Several potato farms grow processing vegetables and other specialty crops essential for diversification of Wisconsin agricultural industries. Over 2,000 Wisconsin residents from nearly 100 hundred businesses work within the potato industry.

Benefits realized included:
Little adoption of ESN. Field scale demonstrations 50 or more hundredweight reduction in yield. Trials by Ruark prevented these losses for growers across the state.

Every seed grower is now using insecticidal soap and models predicting aphid flights successfully to reduce PVY infections in seed potato.

80% of potato growers are now using anthrylic diamide as part of Colorado potato beetle management program.

Late blight was confined to a few fields in 2010, 2011, and 2012. Even though disease was present every year, losses in storage were minimal (less than 20%). In contrast, storage losses in 1999-2002 exceeded 25%.

Wisconsin seed producers will plant almost 2,000 acres of new chip lines in 2013 including Nicolet, Accumulator, Lelah, and Tundra from Wisconsin and Lamoka from Cornell.

Findings from this project have changed industry practices in Wisconsin and other states. Results were not just recommended, they were implemented by growers and are impacting the success of their crops.

V. Lessons Learned

This project progressed as planned. Many researchers and cooperators were involved in different aspects of the project but each carried out their part, fucntioning well as a team. Many of the outcomes are on-going as funding from other sources allows us to continue with many of the different parts of the project.

VI. Additional Information

None

VII. Detailed Financial Reports

$74,897.21	Salary/Fringe
$102.70	Travel expenses for field study site visit
$74,999.91 Total	

VIII. Contact Info:

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5) Wisconsin Apple Growers Association

Project Title: Farm Fresh Connections

Total Amount Received: $40,000

Date of Award: December 1, 2009

Project Contact(s): Anna Maenner

Report Date: October 31, 2012

I. Project Summary

Farm Fresh Connections engages consumers with locally grown food. Past globalization of our food system dismantled local food distribution; consumers lost contact with the growers of their food and the knowledge that comes with eating seasonally and locally. Farm Fresh Connections engages consumers helping them to buy local, educating them about where their food comes from, when foods are available locally and how to prepare these foods for inclusion in their diet.

B. Describe how this project complimented and enhanced previously completed work.
Previous SCBG funding created the Enjoying the Harvest activity book. An elementary age appropriate booklet that teaches about produce grown in Wisconsin through fun, educational activities. Farm Fresh Connections provided funding to get this educational book into the hands of children across the state.

Previous SCBG funding also created the Wisconsin Orchard Map, a supportive piece for the Autumn Harvest Trail, also initially supported by SCBG funds. This informative map of Wisconsin's orchards, compliments the online Autumn Harvest Trail which expands beyond orchards to pumpkin farms, on-farm adventures, wineries, local food stores and more.

II. Project Approach

Enjoying the Harvest (ETH): Over 76,000 copies of this educational booklet have been distributed to children across the State of Wisconsin. A cooperative effort, booklets have been distributed in the classroom; on farm tours; at farmers markets; in libraries; by community organizations; at educational events and even at home to homeschoolers. Hoping to distribute 40,000 copies, Farm Fresh Connections exceeded our expectations! ETH was the arm of Farm Fresh Connections that engaged children in learning more about the food they eat. The challenge going forward is that we have exhausted our supply of booklets so we will need to look at new and innovative ways of continuing to educate tomorrow's consumers.

Autumn Harvest Trail (AHT): AHT brought consumers back to their "roots" literally, reconnecting them with the farmers, landscapes and plants that produce the food they eat. Over 40 businesses from all facets of agriculture participated in this on-location activity bringing

consumers to farms, cheese stores, wineries, on-farm markets and more. Over 4,900 visitors signed up at AHT destinations for drawings and to be added to our email newsletter. This database of visitors led to a followup survey, the largest ever nationwide on agricultural tourists, which provided valuable information on the demographics of the on-farm visitor. With the dramatic weather challenges this year, which resulted in reduced crop yields from apples to strawberries, overall participation was down as many on-farm markets did not open or were open for a shortened season. This was a cooperative effort between farm businesses that bring consumers to their location.

Milwaukee County Winter Farmers' Market (MCWFM): If you can't get consumers out to the farm, the next best thing is to bring the farm to the consumer. Farm Fresh Connections created the first "winter" farmers' market in Wisconsin's most populated county, Milwaukee. This effort helped farmers extend their season or enabled them to expand their market offerings and it helped consumers source local products 12 months of the year. Supported the first two years by the Wisconsin Apple Growers Association, this market has now incorporated on its own and is managed by a farmer/consumer board. MCWFM will open for its 4th season on November 3rd with 34 vendors using the market to extend their income-generating season.

This project was requested by members of and administered by the Wisconsin Apple Growers Association. While some Autumn Harvest Trail and Milwaukee County Winter Farmer's Market vendors were not specialty crop producers, the focus of marketing efforts was on specialty crops and specialty crop producers. All Specialty Crop Block Grant Funds were spent to benefit specialty crop producers. Other funds were used to pay for activities benefiting non-specialty crop producers. For example, less than 6% of the market expenses were funded with specialty crop grant funds, but 25% of the initial market vendors were specialty crop producers. Efforts with these funds focused on promotion of specialty crops and recruitment of specialty crop vendors.

Make it Farm Fresh (MFF): A media campaign utilizing social media i.e. Facebook, websites, enewsletters and conventional media i.e. radio interviews, newspaper articles, television appearances, to spread the word about Wisconsin produce, what's seasonal, crop updates, etc. and more. Our Facebook page has grown to 200 likes and websites for all the participating groups have been updated to be more consumer friendly. Numerous interviews have been done with radio, television and free-lance writers on local foods, crop updates, etc. This part of Farm Fresh Connections reached out to consumers that may not be currently engaged in the local food movement. With helpful information, we strive to make all consumers more aware of the agriculture going on around them.

FRESH Magazine: FRESH is the grower communication tool of Farm Fresh Connections. Through FRESH, growers are kept abreast of the latest agricultural practices; pest and disease management, marketing and distribution, food safety and issues of the day. Our distribution has grown to over 1700 from the original 1500 when this project began.

III. Goals and Outcomes Achieved

Enjoying the Harvest was distributed to children across the state through a cooperative effort including schools, farms, community organizations, libraries, etc.

Autumn Harvest Trail was organized and promoted annually. In 2012 we developed an online interactive map for participating businesses. The project incorporated a new QR code technology. A new Orchard Map was printed.

Milwaukee County Winter Farmers Market was established and provides a forum for farmers to extend their season and for consumers to continue to buy locally during the winter months.

Make it Farm Fresh developed a Facebook page and tied the different produce websites together to offer consumer education, recipes, helpful hints, etc. Websites were updated to better meet the needs of growers and consumers.

FRESH has been written, published and distributed with each issue now being mailed to over 1700 fresh market (specialty crop) growers.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Enjoying the Harvest -- Expected to distribute 40,000 books; distributed 76,000 books.

Autumn Harvest Trail - Expected 100 destinations; achieved 43 destinations. Expected 5,000 first-time visitors; achieved 4,900 visitors that completed our signup process. Expected $500,000 in increased sales; unknown, destinations did not wish to share financial information.

Milwaukee County Winter Farmers Market - Expected to run for one year; beginning its 4th year. Expected 17,000 consumers to attend the market; annual attendance has exceeded 17,000. Expected 10 vendors to participate in the market; first season 41 different vendors participated. Current participation for this fall's market is 34 vendors.

Make it Farm Fresh - Expected a 25% increase in unique visitors to websites; Since this project began, all of the websites have gone through an overhaul. Latest stats show that during key promotion periods, website unique visitors exceeded a 25% increase in traffic. Our Facebook page has reached 200 likes.

Over the years of the project there were challenges with computer failures and new website creation which lost data or made previous data inaccessible so we were not able to capture any additional website data.

FRESH - Expected to publish 12 issues; 10 issues have been published. Expected to have 50% of magazine devoted to target topics; Exceeded 50% target content in all issues.

IV. Beneficiaries

76,000 Children benefited through the activity book which taught lessons on how produce is grown in Wisconsin.

Approximately 750 Teachers benefited by seeing and learning to teach Enjoying the Harvest.

Over 23,000 Consumers benefited by having a winter market to shop at (17,000 annually); by having the opportunity to experience agriculture first hand on-farm (4,900 visitors on AHT); by

consumers looking for a weekly shot of information (200 on Facebook). There's no way to count the number of consumers who read articles, heard stories or watched television programs or news reports that passed on information about fresh produce.

1700 fresh market growers receive FRESH and its valuable information; some of those same growers who are members benefit from the added promotion from being on the various websites.

V. Lessons Learned

Technology is changing quickly; platforms or formats thought to be ideal at the beginning of this project morphed and changed each year. Implementation in 2012 contains components never imagined when this grant was written in 2009. It's important that projects remain flexible, able to adapt to changing technologies and communication methods. The goal is to accomplish your mission; not necessarily the method by which that is achieved.

VI. Additional Information

www.waga.org
www.wiberries.org
www.wisconsinfreshproduce.org
www.visitdairyland.com
Make it Farm Fresh Facebook
www.mcwfm.org
Autumn Harvest trail is located on the Apple Site www.waga.org

VII. Detailed Financial Reports

	Budget	Expenditures
Personnel	$ 7,780.00	$ 6,745.00
Equipment	$ 2,710.00	$ 2,710.00
Supplies	$ 1,000.00	$ 1,044.45
Contractual	$ 7,060.00	$ 6,209.40
Other	$21,450.00	$23,372.53
Total	**$40,000.00**	**$40,081.38**

Personnel - Organization staff that carried out the various activities conducted through this grant.
Equipment - Rental of Tommy G. Thompson Building for the Milwaukee County Winter Farmers Market
Supplies - Boxes, drawing slips for the Autumn Harvest Trail & Mailing Labels (the large 1/2 page size) for shipping Enjoying the Harvest
Contractual - Database entry for Autumn Harvest Trail; Website Updates/Modifications, Facebook, Social Media for Make It Farm Fresh Campaign; Design for FRESH magazine
Other - Printing and Mailing of FRESH magazine, Printing of Postcards for Autumn Harvest Trail, Mailing supplies and postage for Enjoying the Harvest and Autumn Harvest Trail, Printing of the Orchard Map; Printing of Window Clings for Autumn Harvest Trail.

*Additional $81.38 was allocated from project 09-017

VIII. Contact Info:

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6) Wisconsin Grape Growers Association

Project Title: Wisconsin Grape Industry Project

Total Amount Received: $35,000

Date of Award: December 1, 2009

Project Contacts: Anna Maenner

Report Date: November 26, 2012

I. Project Summary

The grape trial was implemented in 2007. The vines were spaced at 7' x 10' apart. Fifteen cultivars were selected for inclusion in the trial. Three of the cultivars were removed in 2010, due to lack of winter hardiness or late ripening problems. The 2012 evaluation now includes 12 cultivars that were part of a 2007 planting. Three new cultivars were planted in the May of 2011 to replace three varieties that were removed in 2010. A fourth cultivar was planted in June of 2011. We had been trying to locate Montreal Blue and found it later in the summer of 2011.

The primary purpose of the proposal was to continue and expand on a field trial of new seedless table grape cultivars in Southwest Wisconsin's - Zone 4/5 for fresh market production for a fifth year. A compilation of five years of trial and research fully documented the results of our trials. Grapes maturity is not achieved until the fifth year of growth.

Our main goal for 2012 was to continue the trial of the12 seedless table grape cultivars that were planted in 2007 and overwintered well the last four years. And to determine the fruit quality, quantity and harvest period for all varieties those varieties, and to rate overwintering ability for the three new cultivars planed in 2011. We also continued the program evaluating the length of harvest for each grape variety. Our goal was to determine how long grapes could be left on the vine and still be of marketable quality.

In 2012 there were over 110 farmers growing grapes in Wisconsin and 84 wineries. The growers and wineries have discussed the possibility of growing seedless table grapes as a value added product at the vineyards and farms (Wisconsin Grape Growers Survey – 2012). Community Supported Agriculture (CSAs) wished to expand their fresh fruit market and seedless table grapes would be a late summer into early fall fruit crop that is of high value to expand their market.

Our targeted goal of developing a list of cultivars that will grow well in Wisconsin was achieved. The data collected during the growing season of 2012 provided enough documentation to develop a recommended list of seedless table grapes to grow in Wisconsin. The data shows winter hardiness, spring frost damage to buds, verasion dates and ripening calendar, brix levels, and disease and insect resistance or tolerance.

On the marketing side, the project was to educate consumers on cold climate wine grape varieties. A variety of materials were developed to educate the public so they in turn would look for and ask for these varieties when they wished to purchase locally produced wines.

B. Describe how this project complimented and enhanced previously completed work.
Our main goal for 2012 was to continue the trial of at least 12 seedless table grape cultivars to determine the fruit quality, quantity and harvest period for all varieties planted in 2007 and to rate overwintering ability for the winter of 2011 - 2012. We also continued the program to look at harvest length of the grape clusters. Our goal was to determine how long grapes could be left on the vine and still be of marketable quality.

A secondary goal was to secure three new cultivars to add to the trial. We found four that were of significant value for production in Wisconsin. Three varieties were known in the industry in the United States: Thomcord, Jupiter, and Suffolk Red. An additional cultivar was found that had not been grown in the US on any large scale for many years. This variety was of significant interest to our Wisconsin trials, due to the origin of the selection. An old Elmer Swenson variety – ES6-4-47 (Labeled as Ontario Blue in Canada) was found and added to the trials. This variety is grown in Canada and sold in Canada's Farmer's Markets as "Ontario Blue". (Ontario Blue was being sold in markets when we were traveling there in late September of 2011 and in 2012. The grape was large, very solid and had a very complex taste. A half a kilogram of fruit was selling for $4.99 – Canadian dollars.)

The fifth year funding provided a solid core of data to develop recommended cultivars for Wisconsin. The data for all five years followed the same pattern. The winter hardiness, health, fruit quality and production times proved to be similar for all 12 remaining cultivars for all five years.

II. Project Approach

The weather was very variable throughout the whole year beginning with the early spring of 2012. Early in the spring the unseasonably warm temperatures resulted in early bud break. Bud swell had begun in mid-March. Ten of the varieties broke bud in late March. In April temperatures dropped to 31.9 and 30.7 degrees Fahrenheit. The position of all vines on a slope prevented the cold temperatures from settling in the vineyard. The cold air flowed down into the lower areas of the field. Two of the varieties did suffered a small amount of damage due to the cold temperatures on May 3rd. Venus and Summerset Seedless lost approximately 10% of their buds. The frost damage did not result in a loss that decreased the fruit production below commercially viable rates. An extreme drought developed which necessitated the instillation of a drip irrigation system.

During the pollination period the cold and windy conditions resulted in two varieties having very sparse and sporadic fruit production. Himrod and Einset pollination occurred during a period of cold temperatures with high winds. Fruit cluster that formed had a loss of over 30% of the flowers on each variety destroyed.

The extremely hot weather pushed the development of all varieties by as much as three weeks. Four to six inches of growth was evident on the grapes in early May. This is a benchmark used for first spray. The first spray was not implemented the first week in May. Consequently, fruit

ripening was earlier than during the last two years. On August 13 brix readings and taste testing indicated that several of the varieties were close to harvest point. On August 28 we harvested approximately half of the clusters on all of the varieties.

Canadice, Mars, Interlaken and Lakemont had many clusters that were shaded by heavy leaf cover. These clusters had not ripened by August 28 and were left on the vines. We leaf pruned those varieties allowing the sun to reach the underlying grape clusters. The fruit ripened and the extended harvest was a value we had not expected from the leaf shading.

We will be recommending that growers leave a portion of all grape clusters shaded until late in the ripening season so that an extended harvest is possible for all varieties.

However, as the summer progressed the weather was very conducive to grape growing for much of the season. Fewer disease outbreaks occurred and fewer fungicide sprays were needed. Low humidity, lack of rain, and wind kept the disease outbreaks to a minimum.

The severe drought did result in moisture stress occurring on all of the varieties. Rainfall for June, July and through mid-August was far below normal. A drip irrigation system was installed in July.

Bird Damage

This was the first year we encountered terrible bird damage. Netting on all of the varieties was not implemented in the past growing seasons. The extreme dry weather may have resulted in the birds seeking moisture and fruit in our vineyard.

Starlings in very large numbers attached the fruit of several varieties before we could install bird netting. Vanessa, Trollhaugen, Mars, and Einset lost more than 20% of all fruit due to bird damage.

Fruit Fly Damage

Unexpected damage to all of the early ripening varieties resulted from an infestation of fruit flies. Grapes were submitted to the Insect Diagnostic Laboratory to determine if the fruit flies were Spotted Wing Drosophila. The test indicted that the flies were normal fruit flies. We have not determined how the flies entered the grapes. Not all grapes infected seem to have open wounds. Fruit flies cannot break the skin of the fruit. Next season an IPM program for fruit flies will need to be developed. Trollhaugen, Somerset Seedless, Vanessa, Mars, and Einset had severe damage and the fruit harvested on 9/4 could not be consumed. All fruit was thrown away.

Developing Winter Hardiness

A large part of the work involved developing systems to increase the winter hardiness of all vines grown. The winter hardiness of grape vines can be managed to some extent by the growing conditions in the first four years and the continual management during production years.

Increasing the winter survival rate of cultivars is one management tool that our trials have found to be possible by the following growing methods. Soil test should be conducted to correct any deficiencies before planting the vines. Prepare planting bed and plant vines at the correct depth.

The trellis system should be established soon after planting, so strong shoot and root development begins the first year. The installation of a system that supports the straight trunk development is one feature of the trellising. Straight trunks are stronger than those that are twisted or curved. The first year of growth all possible vine development is encouraged and vines secured to an upright bar established for trunk development. Developing double trunks has worked well in our system. One trunk on a plant can be lost due to winter injury or other problems, and the one remaining trunk will produce fruit. A replacement trunk can be trained from the remaining trunk very easily and less time is lost in production numbers.

Trellising the first year will decrease disease outbreaks. Additionally, as stated above, trellising will establish strong, straight trunks at the very outset.

The second year the two strongest vines should be chosen for the double trunk system for each vine. Cordons should be developed, and fruiting spur positioning managed. All flower clusters should be removed.

The third year cordons should be developed more fully and uprights or vines and fruiting spur placement managed. A few flower clusters may be left on the vines to determine verasion onset and time of final fruit ripening.

The fourth year trellising, trunk and fruit spur development should be in place and the first full crop harvested. Fruit load will still need to be managed to prevent over cropping and overstressing the vines before dormancy occurs.

We are now in the fifth year and harvested a normal load of fruit from all cultivars. Fruit clusters were dropped so over cropping would not slow fruit ripening and normal cluster sizes were maintained.

Winter Injury and Frost Damage

Winter injury data was determined by selecting a few buds on each variety for dissection to check on the health of the primary and secondary buds, vascular health was also check. These checks were completed in early February and March of 2012 at the time of pruning. Visual data was taken at bud break, and damage buds counted on each variety. The low winter temperature recorded at the station was -12.4 ºF near the station headquarters, and -12.8 ºF in a field about 500 feet from the grape plots. Prior years we have had lows of -18.5 ºF and -24.1ºF.

The very mild temperature was conducive to high levels of overwintering of all grape varieties. No buds or vines were damage on any of the 12 five-year-old vines. The four varieties planted in 2011 overwintered well. No damage was evident on any of the four cultivars. Thomcord, a Zone 6 variety, was one variety that we expected to see some damage, but it survived well and showed no bud damage.

The data for all 12 varieties that remained in the trial in 2012 indicates that they will perform well in Wisconsin. We have some concern due to the mild winter and will in the future monitor the cultivars closely. Einset, Marquis, Mars, Reliance, Somerset Seedless, Trollhaugen, Vanessa, and Venus preformed as well as the last four year data shows. The remaining four selections, Canadice, Interlaken, Lakemont, and Himrod overwintered well and produced a marketable crop

in 2012. Production was still quite reasonable, due to strong fruit cluster formation on remaining vines (Appendix – Table 5 – Fruit Set).

Fruit Production

The vines on all varieties grew well. All vines were summer pruned three during the growing season to maintain an open canopy and limit upward growth of the vines.

The extremely hot, dry temperatures resulted in fruit that was high in sugars. The ripening pattern followed the ripening data for 2010. The fruit ripened about two weeks early than in 2010 and 2011.

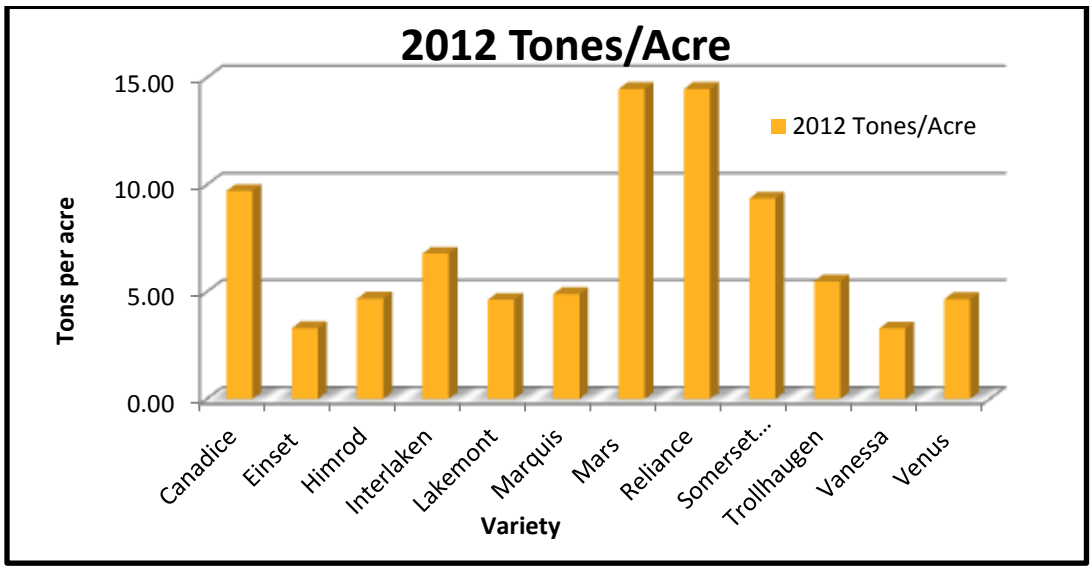
The average per vine production for the 12 cultivars this year was 15.09 lbs. (Appendix – Seedless Table Grape Yields lbs. - Table # 4).

- Canadice had limited winter injury. Average fruit production per vine was 24.52 lbs. Fruit clusters were thinned to two clusters per fruiting spur. Late leave pulling around selected clusters extended the harvest for three weeks.
- Einset had limited frost damage and 15% of all cluster had poor pollination. Average fruit production per vine was 9.99 lbs. Fruit cluster weight and lbs. per acre were less than with expected weights from research and cultivar data.
- Himrod had no winter injury or frost damage. Average fruit per vine was 14.18 lbs. Fruit cluster weight was lower than expected, but total production was in-line with expected production.
- Lakemont and Interlaken produced an average of 13.69 to 14.03 lbs. per vine. Lower harvest totals are due to more aggressive dormancy pruning and fruit cluster thinning to increase winter hardiness. All cordons were pruned leaving no more than 20 to 25 fruiting spurs per vine and clusters thinned to two clusters per spur.
- Marquis averaged over 9.98 lbs. per vine. Fruit clusters incurred pollen damage due to cold temperatures during pollen shed. Approximately 30% of the flowers on almost all clusters were destroyed.
- Mars average per vine was over 14.47 lbs. per vine. Cluster thinning was more aggressive this year and fruit ripened early and more uniform. In 2011 we over-cropped this variety and had over 39 lbs. per vine. Extreme fruit load leads to late fruit ripening and decreased winter hardiness.
- Reliance averaged over 11.25 lbs. per vine. Reliance had uneven ripening during the 2011 season due to over cropping. A more uniform cluster ripening developed in 2012. Fruit cluster thinning was completed early in the season.
- Somerset Seedless averaged 28.97 lbs. per vine. This variety is always the first to ripen and holds fruit for several weeks for a long harvest period.
- Trollhaugen had beautiful fruit that averaged 16.61 lbs. per vine. We dropped fruit cluster and fruit clusters produced a slight larger fruit than last year. Though bird damage resulted a smaller harvest.
- Vanessa has performed well the past three years. In 2011 this variety had winter injury. With the double trunks, we were able to build new cordons and the fruit harvest was at levels we expected. Each vine averaged over 9.96 lbs. Less than expected due to bird damage to fruit clusters in late August.

- We will still be monitoring Vanessa for winter hardiness and production quality in the future. Fruit thinning will be implemented on this selection in the future, also and would be a recommended practice to maintain vigor and quality of the vines.
- Venus, which has performed very well in the past, has been compromised by Crown Gall infection. Average weight was only 1.67 lbs. per vine. This has been one of our favorites for flavor, berry, cluster size, and winter hardiness. We will install a new planting in 2012.

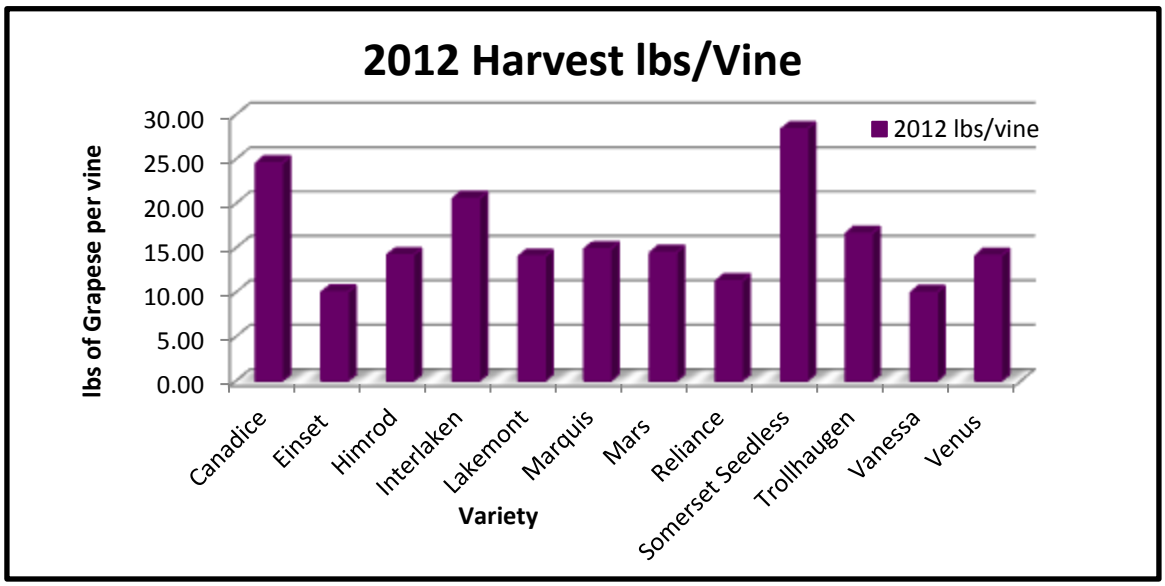
2012 Tons Per Acre

Tons per acre for 2012 were fewer than in 2011. This low harvest tonnage is due to fruit thinning and to bird damage: Chart # 1 – 2012 Tones/Acre.



2012 Harvest lbs/Vine

Pounds per acre for 2012 were few than in 2011. This low harvest tonnage is due to fruit thinning: Chart # 2 – 2012 Tones/Acre.



Cluster Weight

Weights, of the clusters, were close to or exceeded the cluster size set by the research for each cultivar: (Chart # 3 – Fruit Cluster Weight in Grams) Fruit cluster weights from breeding programs is below for comparison to data of weights from West Madison Trials: (Chart # 4 – Fruit Cluster Data Collected from Breeding Program Research Sites

Chart # 3 - Fruit Weight Grams/Cluster – 2012 – West Madison Ag Research Station

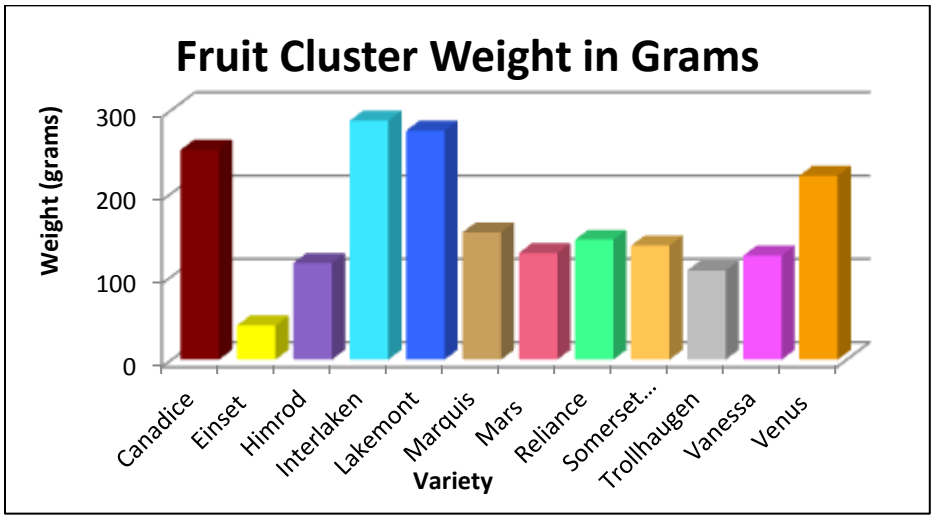
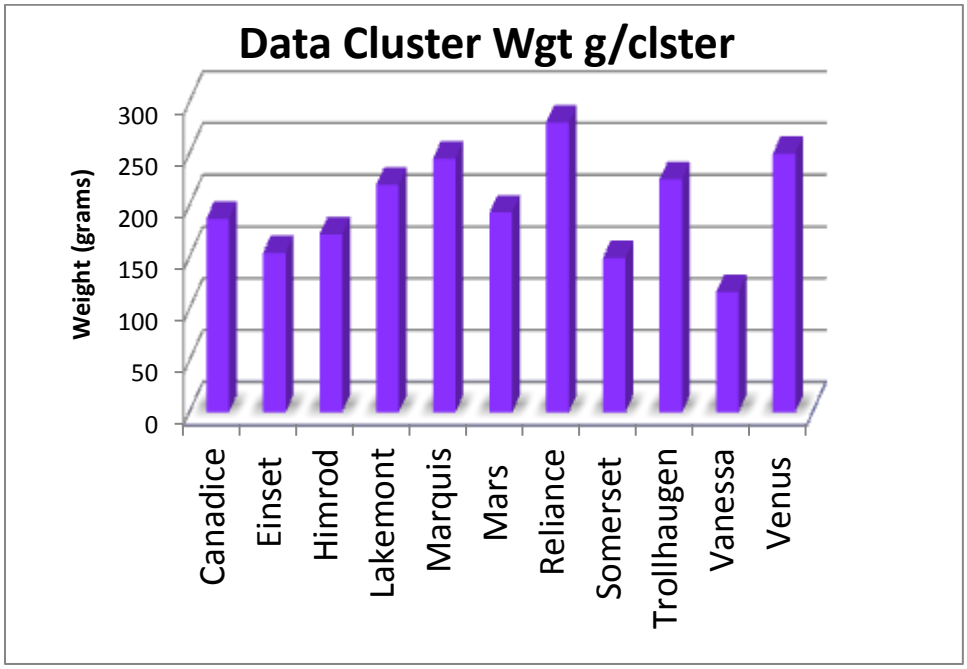


Chart # 4 – Expected Cluster Weights for Cultivars – Data Gathered from Research Sites



Marketing: A cold climate grape variety poster, a Wisconsin grape wheel, and a full-color brochure were developed and printed. We produced 1000 posters; 2500 wine wheels, and 10,000 brochures. Our goal for the grant was to distribute 500 posters; we have distributed 800 posters. Our goal was to distribute 750 wine wheels and we have distributed 2500 and have reprinted. Our goal was to distribute 10,000 brochures; we distributed the original printing of brochures and have reprinted.

III. Goals and Outcomes Achieved

See activities performed in secton II.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Our first goal was to secure data that would prove the hardiness of the varieties in the trial. The data over the past five years has shown and visual observations, along with taste testing, that at least eight of the varieties are quite winter hardy. Four others are variable in the hardiness we have observed.

A publication that will be distributed to growers, extension agents, and other educators shows the result of our five-year study: see attached sheet.

One new goal was to monitor for length of harvest in 2012. Our goal was to find the extended harvest window for all of our winter hardy cultivars. Verasion was recorded on August 13 for three varieties. All varieties had reached verasion by august 27. Ten to 15% of the fruit on each cultivar was harvested every two to three days from August 27 – September 4, for a total of nine harvests. (Table 4 - Harvest Period for All Varieties/Percent Verasion).

Fruit Set

Table 4 Extended Harvest Data

	8/13/12	8/17/12	8/23/12	8/27/12	8/28/12	8/29/12	8/30/12	9/4/12	9/11/12
Cultivar Name	Verasion	Verasion	Verasion	Verasion	Verasion	Verasion	Verasion	Verasion	Verasion
Canadice	0%	30%	50%	100%	100%	100%	100%	100%	still hrvst few
Einset	0%	90%	100%	100%	100%	100%	100%	100%	hrvst cmplt
Himrod	0%	90%	100%	100%	100%	100%	100%	100%	hrvst cmplt
Interlaken	0%	50%	90%	100%	100%	100%	100%	100%	still hrvst few
Lakemont	0%	80%	90%	100%	100%	100%	100%	100%	still hrvst few
Marquis	0%	90%	90%	100%	100%	100%	100%	still hrvst few	hrvst cmplt
Mars	0%	75%	85%	90%	100%	100%	100%	100%	still hrvst few
Reliance	0%	50%	80%	100%	100%	100%	100%	100%	still hrvst few
Somerset Seedless	100%	100%	100%	100%	100%	100%	100%	hrvst cmplt	hrvst cmplt
Trollhaugen	100%	100%	100%	100%	100%	100%	100%	100%	still hrvst few
Vanessa	75%	90%	100%	100%	100%	100%	100%	100%	hrvst cmplt
Venus	50%	85%	85%	100%	100%	100%	100%	100%	still hrvst few

Somerset Seedless, and Trollhaugen Brix readings on August 13 had attained the brix range of harvestability. Also, a taste test proved that both cultivars reached full verasion. It is possible they could have been harvested the week of August 8. The extreme hot weather pushed the grapes faster than we had predicted. The brix levels rose several tens in one day during the early stages of verasion.

Trollhaugen and Venus were harvested nine times. The final harvest, on 9/11, the quality had decreased below marketable quality. Sugars levels had begun to fall, individual berries were becoming shrunken and insects were beginning to damage many of the berries. The majority of the fruit on all vines was harvested on September 11 due bird damage and high temperatures drying fruit.

A late harvest might be possible with increased numbers of vines or acreage of table grapes. In 2013, we will be rating harvest period for all selections for a third year.

IV. Beneficiaries

In January of 2012 information was presented to the grape growers and wine producers at the Wisconsin Fruit and Vegetable Conference. A PowerPoint was presented on the table grape program updating the information garnered during the 2011 season. Over 78 people attended the presentation.

West Madison was the host site for two field days. One was for the general public and part of Urban Horticulture Field Day and held on August 21, 2012. The attendance for that field day totaled over 600 people and we did provide tours and information for those attendees.

West Madison Ag. Research Station hosted a Commercial Grape Growers field day on August 23, 2012. We had over 52 individual growers, and 8 educators. Information was presented on the history of the grape project, overall success, trellising, and pruning. Demonstration of the sequence of pruning and trellising for first year, second year old, and three-year plantings was part of the program.

The seedless table grapes were just ripening and all attendees were given the opportunity to taste the harvest from 12 of the varieties. Participant's comments were again very favorable and many were very surprised at the quality of the fruit produced and quantity of grapes on the vines.

The During the summer of 2012 we worked with State Extension Specialist, Wisconsin Grape Growers Association, Individual grape growers, and University of Wisconsin - Madison researchers to present field days, and other outreach activities.

Trials at the station have continued to be a draw for experienced grape growers as well as prospective growers. During the months of August, September, and October over 12 different individuals dropped in to request information, ask for tours, and discuss growing methods for table grapes. E-mails are exchanged often with individuals seeking help with growing grapes - numbers have not been maintained for the e-mail exchanges.

Electronic Media Dissemination of Information:
Information was disseminated at field days and in following publications and or electronic media

for growers to access: website, blogs, newsletters, Extension news releases, and with the Wisconsin Grape Growers Association web sites.

A fact sheet was developed that will be published on West Madison Agricultural Research blog: Blog address: http://universitydisplaygardens.com, the new UW fruit web site developed by Dr. Rebecca Harbut and the Wisconsin Grape Growers web and blog: Blog address http://www.**wigrapes**.org/. Fact Sheet (Attachment # 2).

The blog had over 164 visits in one day when we released information on the table grapes in August. The overall viewing for 2012 was 19,130 visits.

Ms. Reith-Rozelle will be presenting a PPT during the January 2013, Wisconsin Fresh Fruit and Vegetable Grower's Conference. She will be presenting all the data collected during the 2011 growing season and releasing the list of recommended varieties.

Grape Field Day

Dr. Rebecca Harbut – Grape Field - 2012

V. Lessons Learned

The project has been far more successful than we as a team set for goals in 2007. Our goal was to find at least three to four varieties that would prove be wintery hardy, produce fruit that would ripen during Wisconsin's relatively short growing season and be of high eating quality.

Twelve of the varieties can be grown in different regions of the state and produce viable crops. This has been an exceptional outcome for the trials. Without the opportunity provided by the grants grape growers would not have the opportunity to begin growing many of the seedless table grapes in Wisconsin. Most growers we spoke with did not or would not have the money, time or inclination to begin testing different varieties for winter hardiness.

The trials also documented that disease, insects and other growing problems could be controlled and a commercially viable crop grown.

The summer of 2012 proved to be a frustrating year for growing grapes. Temperatures in the 90's and the dry conditions were exerted extreme stress on all the vines. The underside of the leaves on six varieties of the grapes developed a very hairy appearance that at first glance was

diagnosed as spider mite damage. On closer inspection with a microscope, no mites could be found. Only a very complex mass of **trichomes** (small hair like structures found on plant tissue, often on the underside of leaves.) or "hairy" development was visible. In addition, several varieties developed a leaf curl that did not show any symptoms that were correlated to any grape diseases. The grape team developed a modified IPM program; one that included more work with microscopes, and lab testing.

VI. Additional Information

Canadice 8/2012

Lakemont 8/2012

Collection of Grape Varieties - 2012

Vanessa 8/12

Five-year Old Vines – with Bird Netting - 2012

Data Collection - Appendixes
See Excel Spread Sheets for information on trials: Table 1 - Grape Plot Map, Table 2 - Overall Hardiness and Disease Ratings, Table 3 - Bud Break, Table 4 - Verasion 2012, Table 5 - Fruit Set, Table 6 – Brix Readings, Table 7 – Fruit Cluster and Berry Weight 2012, Table 8 – Total Fruit Weight and Harvest Dates 2012, Table 9 – Insect Ratings, Charts 2012

VII. Detailed Financial Reports

	Budget	Funds Expended
Personnel	$ 2,600	$ 2,983.00
Contractual	$ 1,920	$ 3,790.00
Contractual Grape Trial	$19,748	$19,732.04
Other	$10,732	$ 8,854.73
Total	**$35,000**	**$35,359.77**

*Additional $359.77 was allocated from project 09-017

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7) Board of Regents, University of Wisconsin System, UW-Extension

Project Title: Improving bush-type hazelnuts for commercial production through cooperative regional breeding and evaluation

Total Amount Received: $33,000

Date of Award: December 1, 2009

Project Contacts: Jason Fischbach

Report Date: October 31, 2012

I. Project Summary

Bush-type hazelnut is a potential low-input perennial crop for Wisconsin growers with uses as fresh-eating nuts, edible oil, confections, bioenergy, and bioproducts. Early-adopters of bush-type hazelnut production have collectively deployed a significant population of genetically unique plants originating from three way crosses between European (C. avellana), American (C. Americana), and Beaked (C. cornuta) hazelnut. Survey work to data has identified more than 130 growers with more than 75,000 living plants. Collectively, these early-adopters of bush-type hazelnuts have deployed a significant population of genetically unique hazelnut plants, providing a tremendous opportunity for mass selection and rapid genotypic gain. Individual growers with maturing plantings have begun the process by recognizing their highest-performing plants and seeking assistance for propagation of these promising plants. However, despite identification of superior plant material in these plantings, the industry has not yet produced advanced clonal material due to unresolved vegetative propagation challenges and, particularly, a lack of replicated performance data. In other words, turning the large pool of hazelnut genetic diversity into locally-adapted commercially viable hazelnut cultivars will require a coordinated screening and breeding program involving on-farm plant evaluations, feasible small-scale clonal propagation techniques, and replicated performance trials.

Perhaps more significantly, the two native hazelnut species (American and Beaked) are found in extensive wild populations throughout WI and have never been screened for high-performing plants. Combined, the native populations of American hazelnut and the on-farm hybrids represent considerable opportunity for development of a commercial hazelnut industry in WI.

The purpose of this project was to lay the groundwork for a coordinated and grower-driven plant improvement program that would eventually yield locally-adapted proven cultivars. Specifically, this project would conduct initial screening of hybrid and wild populations of hazelnuts for high-performing accessions, establish replicated performance trials, and develop molecular tools for understanding genetic diversity and EFB resistant of hazelnut populations.

II. Project Approach

The following is an update as to the progress of each of the components of this project:

On Farm Hazelnut Screening and Evaluation Program (Hazelnut Improvement Program (HIP)
The primary objectives of this component of the project were met in 2010, however, we have continued the grower outreach and performance trials into 2011 and beyond. Specifically, training on the Hazelnut Improvement Program was provided at:

2010
Upper Midwest Hazelnut Growers Conference, LaCrosse, WI (115 attendees)
Wisconsin Hazelnut Field Day, Princeton, WI (22 attendees)
Minnesota Hazelnut Field Day, Lake City, MN (35 attendees)

2011
Upper Midwest Hazelnut Growers Conference, St. Paul, MN (65 attendees)
Wisconsin Hazelnut Field Day, Viola, WI (48 attendees)
Minnesota Hazelnut Field Day, Lake City, MN (63 attendees)

2012
Upper Midwest Hazelnut Growers Conference, Dubuque, IA (70 attendees)
Wisconsin Hazelnut Field Day, Eagle, WI (20 attendees)

A HIP training video was created in 2010 and posted on the Upper Midwest Hazelnut Development Initiative website (www.midwesthazelnuts.org). As of October 31, 2012, Part 1 had been viewed 1438 times and Part 2 had been viewed 214 times. Printed materials supporting the Hazelnut Improvement Program are also available on the website. Onion harvest bags with HIP data collection tags were sent prior to the 2012 harvest to more than 80 hazelnut growers in the Upper Midwest along with instructions about the Hazelnut Improvement Program. This serves as both an education tool and, more importantly, should result in increased data collection by growers.

In cooperation with Dr. Lois Braun at the University of Minnesota, 70 accessions of these hybrid plants were identified, mound-layered, and the layers used to established a performance trial in Bayfield, WI in the spring and fall of 2010 and another in Tomahawk, WI in the fall of 2011. See attached Newsletter Article. An additional 20 hybrid accession will be added in November of 2012. This work has been done primarily with other funding sources, but this project helped Lois and the growers identify the high-performing plants.

Wild Hazelnut Screening
During the fall of 2010, 24 sites across 8 Northern Wisconsin counties with dense populations of American hazelnut were screened for high-yielding plants. At each site, 100 plants were visually screened and assigned a yield score. The nut clusters were harvested from the 10 plants with the highest yield score, dried, and weighed to determine total in-shell nut yield. A sub-sample of the nuts were cracked and weighed to determine total kernel yield. Plant width was used to determine kernel yield per square foot for each plant in order to compare yields among the plants. A research bulletin was prepared reporting on this data and is available at www.midwesthazelnuts.org. In March of 2011, Jason Fischbach presented the yield information at the Upper Midwest Hazelnut Growers Conference.

In the fall of 2010, the top two plants from 10 of the 24 sites were dug and transplanted to the Bayfield Performance Trial to provide plant tissue for propagation work. In March of 2011, stem cuttings were harvested from the top two plants at 14 of the 24 sites and used to graft onto American rootstock. This work was done by Mike Demchik in Steven's Point and proved largely unsuccessful. In addition to the stem cuttings, we dug the roots and crowns from the top 5 American hazelnut plants identified in our assessment work and grew them in pots. The plants were used by Dr. Brent McCown to evaluate micro-propagation techniques. He has been successful in developing a system that rejuvenates the field-dug material in the greenhouse to produce shoot tips that can be successfully rooted to produce clonal propagules. (See attached article) Funding for this propagation work came from a different grant source.

In the fall of 2011, the top ten plants identified in the 2010 screening were revisited to evaluate nut yield. The 2010 and 2011 data were combined to select the top ten plants across all 18 sites evaulated in 2011. The selections were made based on overall and consecutive year yields. These ten plants were dug and divided with one half transplanted to the Bayfield Performance Trial and the other half transplanted into pots for over-wintering. The field transplanted plants are alive and looking good in the Bayfield Germplasm Trial, but unfortunately the potted plants failed to survive.

With funding from the Federal Specialty Crop Research Initiative program the same wild screening protocol was implemented at 15 additional sites in 2012 and the top two plants from each site have been dug and transplanted to the Bayfield Germplasm Trial. A portion of each plant is now in pots and will be forced this winter to harvest shoot tips for clonal propagation.

American Hazelnut Oil Analysis

Although outside the scope of this project, the hazelnuts collected from the screening work, were sent to Dr. Jim Lane at UW-Superior for extraction and characterization of the oil. The 2010 extractions are complete and the results are exciting. Oil yield is roughly 60% of the kernel weight and the monounsaturated fat content averaged 85% with little variability across genotype or location. The results suggest the hazelnut oil has potential as a superior salad oil and excellent feedstock for biodiesel or SVO.

Hazelnut Genetic Diversity Analysis and EFB Screening

The primary purpose of this portion of the project was to validate the use of existing molecular markers for american hazelnut and to develop novel markers in order to conduct genetic diversity analysis and screening for EFB resistance. To date, Dr. Anthony Kern of Morningside College (formerly of Northland College) has demonstrated the viability of using 20 existing markers and has developed an additional 15 novel markers. The LTE Hazelnut Coordinator collected leaf material in the spring of 2011 and 2012 in support of this genetic diversity work.

Additional funding for this work was secured for Dr. Kern and Dr. Michael Demchick through the WIST and federal Specialty Crop Research Initiative program. The markers are currently being used to characterize the genetic diversity of hazelnut populations across Northern Wisconsin with submission of the first journal manuscript scheduled for February 2013. Such funding would not have been available without the foundational work funded by this project.

Screening for EFB Resistance
Additional DNA was collected in the spring of 2011 and will be used over the next year to screen the American hazelnuts for EFB resistance loci.

Although outside the scope of this project, we collaborated with Dr. Tom Molnar from Rutgers University and harvested EFB cankers from plants throughout WI. The cankers will be used in Tom's work to characterize the genetic diversity of EFB.

III. Goals and Outcomes Achieved

Hazelnut Improvement Program
Direct training on how to evaluate and record performance data from on-farm hybrid plantings was provided by Jason Fischbach to 438 learners during this project. In addition, the hazelnut training video has been viewed nearly 1500 times and the printed materials have been used by collaborators of the UMHDI to teach growers. To date the online HIP database has 18 users with data entered on more than 530 plants. Much of this individual plant data was entered by collaborating researchers.

Onion bags with HIP tags were sent to growers in advance of the 2012 harvest to assist with their data collection. The intention is for growers to harvest individual top plants into an onion bag, fill out the data collection tag and store the bag until the husks are dried and nut yields can be determined later in the fall. This new approach will result in additional data being collected and provides an educational tool about HIP.

Over the long term, HIP will allow us to more efficiently screen hazelnut populations, enhance grower networking and ownership of the hazelnut development process, and increase knowledge about the importance of cultivar development in the grower community.

Identification of High-Performing Hazelnut Accessions
This project has allowed us to identify 78 high-yielding plants from 39 sites across 8 Counties in NW Wisconsin. This far exceeded our original goal of 20 plants. More importantly, this project has led to establishment of the Bayfield Germplasm Trial in Bayfield, WI and the Tomahawk Germplasm Trial in Tomahawk, WI. The attached newsletter article describes in more detail these plantings. Site preparation on a third Germplasm Trial began in October 2012. This third trial will be located on the heavy clay soils near Ashland, WI at the Northern Great Lakes Visitor Center and the first accessions will be planted in November 2012. Thanks to this project, WI is now an established participant in the plant development process for the emerging hazelnut industry.

Development of Molecular Markers
The original goal for this project was to validate the use of molecular markers for analysis of genetic diversity and EFB resistance screening. Dr. Tony Kern has successfully demonstrated the use of 20 existing markers and has developed 20 novel markers. The work has led to additional funding supporting the actual genetic diversity analysis and EFB screening. A journal manuscript reporting the results is scheduled for submission in February. Preliminary results suggest that the population of American hazelnuts in Northern Wisconsin has highly diverse and that selection of plants within a given geographic location will be as effective as selecting plants across a broad geographic range.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.
See above sections

IV. Beneficiaries

The primary beneficiaries of this project are the more than 130 existing growers in the Upper Midwest. Specifically, the germplasm trials will result in identification of top plants for possible release as improved and locally-adapted cultivars. The attached Research Bulletin demonstrates that many of the existing hybrid genotypes have demonstrated the potential to produce yields sufficient to support an economically viable industry. The Germplasm trials will validate these yields across a range of locations with replicated out-plantings of the top plants scheduled for 2016.

The Wisconsin Hazelnut Research Team and the hazelnut research community in general has benefitted from validation of the use of molecular markers for genetic diversity analysis and rapid EFB screening. Both will allow for more rapid development of improved germplasm.

As the Research Bulletin demonstrates, existing hazelnut germplasm has the potential to support cumulative net income to growers commensurate to blueberry production ($20,000 net income per acre at year 15). Seeing this opportunity, growers have begun developing processing technology and are in discussions toward formation of grower-owned hazelnut processing companies.

V. Lessons Learned

With limited resources we have made significant progress toward development of a commercial hazelnut industry in the Upper Midwest. The identification of superior plant material and establishment of replicated germplasm trials is a tremendous accomplishment that puts us one step closer to releasing proven hazelnut genetics of the Upper Midwest. The potential benefits of a viable Midwest hazelnut industry are huge. First, it would provide another economic opportunity for growers at a scale similar to the cranberry industry, an industry that is working with plant material only two generations out of the wild. Both Ferraro-Rocher and Fisher Nuts are located in the Great Lakes region and import nearly 100% of their hazelnuts from Turkey. With demonstrated superiority as a biofuel crop, the market potential for hazelnuts is virtually unlimited. Second, because the plants are perennial and grow as shrubs, they deliver significant conservation benefits. If deployed correctly, hazelnuts could provide economic opportunity to growers and deliver the conservation benefits that government agencies pay for through set-aside programs. An economically viable crop that provides conservation benefits is exactly what our agricultural system needs.

Carrying this plant development process through without significant financial support will be challenging, particularly with no well-organized and funded grower associations.

VI. Additional Information

None

VII. Detailed Financial Reports

	Budget	Actual Expenditure
Salary/Fringe	$13,504	$16,468.36
Contractual	$15,186	$12,106.74
Web development		
Hazelnut assessment		
Hazelnut mulching		
Hazelnut propagation		
Supplies	$1310	$4424.9
Plant production supplies		
Propagation supplies		
GPS locators		
Other:	$3000	$0
hybrid grower stipend		
Total:	$33,000	$33,000

There were some changes to the budget in response to changes in the project:

Grower Stipends: As high quality on-farm plants were identified through HIP and by our collaborating researcher from the University of Minnesota (U of MN), it became clear that growers were not requesting stipends for us to propagate and evaluate their material in replicated germplasm trials. Instead, these dollars were used to support the germplasm trials themsleves including paying for supplies such as fencing, mulch, and contractual labor at the Bayfield Germplasm Trial.

Northland College Subcontract: Only a portion of this budgeted item was expensed as the contracted faculty member at Northland (Dr. Tony Kern) went on sabbatical to work on a similar project with funding from other sources. This allowed us to put the dollars into the Hazelnut LTE Coordinator positon to expand our screening of the american hazelnut populations in support of the genetics work. We were able to collect leaf material during the spring season and dig the select plants in the fall. The transer also allowed us to purchase materials for a hazelnut husker and cracker to greatly speed hazelnut sample processing.

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8) REAP Food Group

Project Title: Processing Fruits and Vegetables for Wisconsin Schools

Total Amount Received: $20,000

Date of Award: December 1, 2009

Project Contacts: Mirium Grunes

Report Date: December 30, 2011

I. Project Summary

Nation-wide and here in Wisconsin, the demand for locally grown fresh fruit and vegetables in K-12 schools is on the rise. Health agencies have called for increased consumption of fruits and vegetables as a key strategy to increase the health status among children, with schools seen as critical sites for improving children's diets. Schools are recognizing their role in fostering healthier eating patterns in the wake of the obesity and childhood diabetes epidemic. A transformation in school meals to inclusion of more fresh fruits and vegetables could provide a significant market opportunity for Wisconsin specialty crop growers. However, tight budgets and the lack infrastructure make it very difficult for many school districts, especially larger school districts, to process their own produce. Statewide, there have been few to no options for the local processing of WI produce into ready-to-use forms for schools. REAP Food Group developed a classroom snack program to offer minimally processed Wisconsin fruits and vegetables to students in order to build capacity toward processing solutions that eventually will serve entire school districts.

The purpose of this project is to expand the school snack program, to strengthen purchasing relationships between schools and local produce farms, and to demonstrate the viability of processing local produce as a business.

II. Project Approach

Project Activities and Results

1. ACTIVITY: *Identify schools to receive snacks, coordinate purchase and delivery of fruits and vegetables from growers, recruit teams of volunteers to prepare snacks, and coordinate delivery of snacks throuh Madison Metropolitan School District*:

There were four Madison schools benefiting from the USDA Fresh Fruits and Vegetable Snack Program (FFVP) funding as we began this grant in the 2009-2010 school year. We approached the remainder of the elementary schools in Madison and were able to identify seven additional

schools willing to raise the funds through their PTOs. The following year, eight Madison schools qualified for the Fresh Fruit and Vegetable funding. We began the 2010-2011 school

year serving eight schools on the FFVP plus seven that were self-funded for a total of 15 schools. We soon learned that this number was well beyond our capacity for production. Since funding for the FFVP schools was guaranteed and because these schools had populations of greatest need (highest percentage of children qualifying for free or reduced price lunch), we made the difficult decision mid-way through the school year, to stop servicing the self-funded schools. While we thought ten schools was our optimal number, it would not have been fair to accept some self-funded schools and not others. In 2011-2012, two additional Madison school qualified for the FFVP funding, bringing us to our goal of serving 10 schools.

CONCLUSION: Several additional schools within the Madison School District and neighborhing school disticts have expressed the desire to participate in the REAP Farm to School Snack Program; however, at this time, we have reached our capacity with processing and can not expand the program to other schools. We do offer advice to these other schools and help them implement their own programs.

2. ACTIVITY: *Coordinate purcahse and delivery of fruits and vegetables from growers*:
REAP has purchased the following specialty crops from over 25 Wisconsin growers for the snack program: red peppers, cherry tomatoes, carrots, kohlrabi, apples, green beans, brocoli, cauliflower, romanesco, sweet potatoes, sweet corn, heirloom potatoes, spinach, beauty heart radishes, cabbage, cucumbers, asparagus, salad mix, concord grapes, and beets. Over 25 farms have benefitted from these purchases. Most have delivererd to our snack preparation facility. REAP staff have had to pick up from 6-7 - either at their farms or meeting them at the farmers' market.

CONCLUSION: There are an adequate number of farms with the types of produce suitable for the snack program to meet the needs at this level. For some of these crops, it's unclear if there is enough product availability for significant growth.

3. ACTIVITY*: Obtain a processing license and meet all required food safety and handling procedures:*
Utilizing rented space, the facility was already inspected and licensed as a production kitchen. REAP obtained a processing license and obtained Serve Safe licenses for key staff. Proper refrigeration and sanitation protocols were followed at every step of the process.

4. ACTIVITY: *Recruit teams of volunteers to prepare snacks*:
In the 2009-2010 school year and 2010-2011 school year all snacks were cleaned, peeled, chopped and packaged by teams of volunteers on Sundays in the RP's Pasta Company's facility. Volunteers were recruited weekly and supervised by the Snack Production Coordinator. REAP has more than 80 currently active volunteers who have assisted with snack preparation and other Farm to School Activities. Most weeks an adequate number of volunteers were solicited (12-15 in 4 hour shifts), but there were weeks that recruitment fell short and there were weeks that scheduled volunteers did not show up. On the other hand, there were weeks that unscheduled volunteers came to prep day. Reliabilty of volunteer attendance was always a concern. Productivity consistancy from week to week was also an issue as volunteers came with varying degrees of skills or hard-work ethic. On weeks that the snack production could not be completed on Sundays using the volunteers, REAP staff would need to come in Monday and Tuesday nights after 9pm (after the pasta production crews had left the facility) to finish. Beginning this year (2011-2012 school year) snacks are being prepared by a team of participants in a work readiness

program managed by the Catholic Multicultural Center (CMC). These program participants are supervised by a CMC teacher and REAP staff.

CONCLUSION: There are an amazing number of dedicated volunteers willing to give up their Sundays to prep produce for school children. However, this model does not provide reliable productivity. Thus far, we are finding the work readiness program is having similar issues with poor reliability and a wide range of skill levels. Eventually this type of production must be turned over to consistant staff with strong leadership.

5. ACTIVITY *Coordinate delivery of snacks through Madison Metropolitan School District*:
REAP has successfully developed a working relationship with MMSD to pick up the prepped product from our facility and deliver the bags of produce to the schools. Each school has a snack coordinator that receives the produce and distributes to classrooms in the school.

CONCLUSION: MMSD is willing to provide infrastructure support to serve fresh local snacks to their students.

6. ACTIVITY: *Record # of lbs of vegetable snacks provided to schools, # of labor hours to produce the snacks, and all associated costs (food, supplies, etc.)*:
Please see the attached Excel spreadsheet titled "Cost per product summary" for a brief summary of produce costs and labor.

7.ACTIVITY: *Purchase and test food processing equipment and supplies*:
REAP has purchased several pieces of portable and affordable processing equipment in order to increase the efficiency of the vegetable processing. Most specifically, funds from the Specialty Crop Grant were used to purchase two industrial fry cutters, scales, an industrial salad spinner, and a heat-sealer. All of this machinery can be safely and easily used by untrained volunteers.

CONCLUSION: While the equipment that was purchased through the Specialty Crop Grant has increased the number of work stations, and therefore decreased the total number of hours needed in the processing facility, it did not consistently improve labor hour efficiency..(e.g. two people worked 4 hours rather than one person working 8 hours.) In order to increase efficiency to the level necessary to further expand the program, we would need a permanent location that could house permanent, highly automated equipment.

8. ACTIVITY: *Provide food education activities in snack school classrooms*:
Currently, REAP provides in-class education at all ten of the snack schools. Education is provided to one grade level, so as the children move through the grades, they will all receive the in-class education. In addition, a weekly "Snack Bite" is sent to all of the teachers at each of the ten schools. This educational handout includes fun facts and interesting information on the local products and the source farms.

CONCLUSION: The in-class education is a valuable component of the success of the snack program. Many teachers have reported that there is an increase in the amount of fresh fruits and vegetables the students eat after they have been engaged in the classroom activities.

9. ACTIVITY: *Survey teachers at snack schools*:
Each April, the teachers at the snack schools are surveyed to find out more information on how to successfully implement the program. According to the teacher surveys, the percentage of students eating the snack has increased from 65% to over 83%.

CONCLUSION: These surveys have proved very informative. REAP will continue the practice of implementing these surveys beyond the period of this grant.

10. ACTIVITY: *Manage finances for snack program including paying growers for product, invoicing schools for snacks, and managing financial records for the grant*:
REAP has successfully managed the financials for the snack program.

11. ACTIVITY: *Assess capacity to expand*:
With the help of the grant funds to purchase supplies and hire a snack program coordinator, REAP was able to expand to the goal of serving 10 elementary schools.

12. ACTIVITY: *Summarize production and financial data and present to managers of area processing facilities*:
REAP has successfully transferred production from a volunteer labor run program to an independent facility run by the work readiness program at CMC. The CMC program is using the processing protocols and best practices developed during the 2010-2011 school year. REAP successfully coordiates with the processing facility so that they may process more than 4500 servings per week. In addition, REAP is engaged in conversation with two other local processing facilities for the 2012-2013 school year.

13. ACTIVITY: *Encourage and facilitate farmers to obtain GAP certification from the USDA*:
One of the biggest hurdles to increasing the amount of local produce in the Madison Metropolitan School District is the requirement that all produce served in the school meal program (not the snack) come from a farm that is GAP certified by the USDA. This is extremely prohibitive to the small to mid-sized diversified farmer that is the target vendor for REAP's Farm to School program. REAP worked extensively with Keewaydin Organics so that they might obtain their GAP certification for four products: tomatoes, peppers, carrots, and green beans.

CONCLUSION: In order to successfully expand the amount of local produce used in the Madison Metropolitan School Distict, it is necessary to encourage/facilitate more area farmers to receive their GAP certification.

III. Goals and Outcomes Achieved

Goal 1: Increase the number of schools receiving fresh fruit and vegetable snacks through REAP so as to increase the volume of Wisconsin produce served in schools.
When we first began the snack program we recruited participation from both schools that had grant funding from the USDA Fresh Fruits and Vegetables Snack program, and from schools that raised money on their own to purchase the snacks. As the number of USDA FFVP funded schools in the MMSD increased from four to eight and now to ten, we are no longer able to service the schools that were self-funded. We have helped two of those schools create their own snack programs using parent volunteers. We are pleased to have achieved our goal, and we have

no doubt that more schools would purchase snacks if there was a facility able to meet the increased demand.

GOAL II: Increase efficiency of processing fruits and vegetables.
Without the resources to install very expensive hi-efficiency equipment, we remained mainly reliant on the people-power and space limitations of our host sites. We chose equipment that was portable, affordable, and easiest to train our mostly unskilled volunteer labor. We hired a snack coordinator during the 2010-2011 school year with strong kitchen skills who could demonstrate and train the volunteers. He created product-flow changes that significantly helped with efficiency but ultimately found that with the high variability in who would sign up from week to week, he could not rely on consistently high productivity. This would clearly be improved with consistent and trained personnel and permanent facilities that could invest in high efficiency equipment. In addition to a high level of variability within the work force, there is a high level of variability within the quality of produce from farm to farm.

GOAL III: Maintain or improve the percentage of students eating vegetable snacks at participating schools.
Our activities toward this goal include extensive educational programming in the schools that are served the snacks. Each week the teachers receive a printed "Snack Bite" that provides information about the fruit or vegetable as well as information about the farm it came from. Additionally REAP staff, AmeriCorps volunteers, chefs, and farmers visit the classrooms with tasting and educational programming to reinforce children's willingness to try new fruits and vegetables. Many of the schools additionally schedule a field trip to an area farm where students can see, taste and feel produce right out of the ground.

GOAL IV: Promote supplying ready to use fruits and vegetables to K-12 schools as a viable business to area processing facilities.
Currently, REAP is working with Culinary Creations, a local job skills training program administered by the Catholic Multicultural Center in Madison. The job-skills training program teaches 'hard-to-employ persons the skills that they need to be successful in a food service industry career. Currently, two to five participants are working approximately 12 hours per week to process the REAP snack, under the guidance and tutelage of a teacher and two REAP supervisors.

In addition, REAP is pursuing two additional relationships with local processors. Throughout the fall, REAP has been working closely with Keewaydin Organics and the Just Local Food Cooperative which Keewaydin administers. The Just Local Food Cooperative is opening a processing facility slated to be open prior to the beginning of the 2012-2013 school year. REAP, Just Local Food, and the MMSD Food Service have been in conversations to set prices and availability for the 2012-2013 school year. With the opening of this processing center, REAP and the MMSD will have the ability to purchase minimally-processed items directly from the producer, thereby lessening the burden of having to process all of the snack produce.

REAP also has been engaged in conversations with the Madison FEED project which is slated to be up-and-running prior to the beginning of the 2012-2013 school year. Specifically, the Madison FEED project has indicated that they will purchase high efficiency, compressor driven equipment specifically selected to meet the needs of REAP's snack program and MMSD. FEED applied for a Community Food Security grant which includes provisions for training and piloting

the REAP snack program. This facility is extremely promising as the high level of automation will increase the efficiency and decrease the time needed to process local produce.

Lastly, under the direction of a new food service director at MMSD, REAP has renewed its conversations with the school district on the larger topic of school lunch. The district is considering a small amount of in-house processing for some local produce. Specifically, the school district is interested in using local produce in the high school meal program. Because there is more choice, there is a greater flexibility within the high school meal program than the elementary school meal program. In addition, REAP is working with the school district to serve local produce in their summer meal program that would be processed by MMSD Food Service staff.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

REAP has met or exceeded all of the identified goals. Overall, throughout the term of this grant, REAP has increased the amount of local produce procured and processed for use in the Madison Metropolitan School District by more than 300%; REAP has increased the percentage of students eating vegetable and fruit snacks at participating schools from 60% to 86.3%. REAP is currently using a local processing facility to minimally-process the produce for snack, while also cultivating three additional potential processing partners.

Goal 1: Increase the number of schools receiving fresh fruit and vegetable snacks through REAP so as to increase the volume of Wisconsin produce served in schools.

Benchmark: 2008-2009 school year: 4 Madison Metropolitan School District (MMSD) schools, 9400 lbs. of produce.
Target: 2010-2011 school year: 10 MMSD schools, 28,300 lbs. produce
Outcome: 2010-2011 school year: 8 MMSD schools, 22,000 lbs. produce.
2011-2012 school year: 10 MMSD schools, projected 28,900 lbs. produce.

Each week, approximately 4,500 servings of Wisconsin produce is served in the MMSD. These products include: red peppers, cherry tomatoes, carrots, kohlrabi, apples, green beans, broccoli, cauliflower, romanesco, sweet potatoes, sweet corn, heirloom potatoes, spinach, beauty heart radishes, cabbage, cucumbers, asparagus, salad mix, concord grapes, and beets. The portions range from .5 oz. per students (spinach) to the standard 2 oz. per students. On average, REAP procures approximately 850 lbs. of local produce for use in the snack program each week.

GOAL II: Increase efficiency of processing fruits and vegetables.

Benchmark: 2008-2009 school year: average 12 lbs./hour.
Target: 2010 school year: average 24 lbs. per labor hour.
Outcome: 2010-2011 school year: range from 6-28 lbs. per labor hour.

REAP continues to document waste, and processing efficiency by vegetable. This program is offering many more varieties of fresh fruits and vegetables than originally assumed. Density of the produce varies considerably (from spinach to sweet potatoes) and labor demands per item are also quite variable (from washing, peeling, cutting, weighing and packaging kohlrabi sticks to just washing apples.) In the end we found it more useful to consider efficiency efforts differently for each product rather than set an average weight/rate goal.

In addition to the variability between products, overall processing efficiency is extremely dependent upon the skill and efficiency of the workers and on the quality of the produce. As mentioned in other parts of this report, finding a permanent workforce that is highly skilled and trained in the use of hi-tech automated equipment is the most probable means of significantly increasingly the efficiency of processing.

The knowledge we have gathered will prove tremendously valuable as we pursue future processing partners in the coming year. Each facility's internal processing capacities will best serve some products over others.

GOAL III: Maintain or improve the percentage of students eating vegetable snacks at participating schools.
Benchmark: 2008-2009 school year: Teachers at four participating schools reported 60% or more at the snack each week.
Target: 2010-2011 school year: teachers at ten participating schools will report at least 65% of students ate the snacks each week.
Outcome: 2010-2011 school year: teachers at eight participating schools reported 86% of students ate the snack each week. (Note: While a total of 15 schools were served snack for a portion of the year, only eight received snack for the whole year and these eight were the only schools surveyed.)

REAP continues to work to increase the number of students eating the snack at each school through robust educational programming.

GOAL IV: Promote supplying ready to use fruits and vegetables to K-12 schools as a viable business to area processing facilities.
Benchmark: Zero processing facilities aware of REAP's snack program.
Target: Provide three area processing facilities with information on the program.
Outcome: Four potential partnerships forged with local processing facilities.

IV. Beneficiaries

This program has facilitated the purchase of fresh vegetables and fruits from at least 25 different small to mid-sized producers in WI. In 2009, this resulted in more than $17,000 in sales; in 2010, this resulted in more than $19,000 in sales. In 2011, just over $21,000.

This program has benefited an increasing number of children. From four schools to ten (from 1200 students to over 4500). Over 50% of the students in the participating schools are in low-income families. (Schools range from 54% to 82% free/reduced lunch students.) These are children to may not otherwise have significant access to healthy fruits and vegetables and certainly have not had experience with the wide variety of items served through the snack program.

In the fall of 2011, REAP partnered with Culinary Creations, a food service job skills training program to process the local fruits and vegetables for the REAP snack. In less than four months, REAP has paid the CMC more than $2,200 to process vegetables. While still in its infancy, this partnership will continue to provide economic benefit to the job skills training program. This partnership is the foundation of the job skills program and will help ensure that the program is

able to continue to train persons to work in the food service industry and continue to increase the local capacity to process WI produce.

We have further facilitated working relationships between MMSD Food Service personnel and area farmers. Through our coordination, MMSD purchased local green beans, cherry tomatoes, carrots and sweet peppers from Keewaydin Farm this last fall for a lunch pilot program in four schools. Staff at the district benefitted from our experience and advice throughout the process.

V. Lessons Learned

We are pleased that we were able to meet or exceed all the goals we had set for this project. Yet as REAP and MMSD continue to partner to expand the presence of local products within the school, there are several main areas of concern: GAP certification, supply, pricing, and processing ability.

Currently, the school district requires GAP certification for any local produce coming into the meals program. REAP worked closely with Keewaydin Organics to facilitate their GAP certification. In turn, Keewaydin Organics supplied four produce items (cherry tomatoes, red peppers, green beans, and carrots) during a Fall Farm Days Pilot. During four days in the fall, four Madison elementary schools featured these local products in their school lunch. This was a monumental step forward as local produce has not been served as part of the school lunch for almost a decade. REAP will continue to encourage other local producers to obtain GAP certification. Currently, Keewaydin Organics is the only local diversified farm that meets REAPs definition of a small-to-mid-sized producer who has GAP certification. Currently, Keewaydin Organics would not be able to meet the entire demand of the MMSD were they to switch to local produce.

The local REAP snack is purchased by each elementary school under their Fresh Fruit and Vegetable Grants (from the USDA). Currently, REAP charges $0.45 per serving. While REAP has successfully decreased the packaging and operation expenses to $0.08/serving, some of the products we serve do not come in under the $0.45 once labor time is calculated in. Specifically, costs for peppers, asparagus, tomatoes, and green beans push toward the high end. As REAP works with the school district to increase the amount of produce that they source directly from local farms, it may be difficult for local farmers to meet the price needs of the school district on these items. It is less challenging for carrots, kohlrabi, cabbage, concord grapes, apples, and other storage crops. Yet these are not necessarily the products the district is interested in.

REAP's current relationship with a local job skills training program to supply the local snack feels like a big step away from an all-volunteer labor force. While the partnership with the job skills training program is a step in the right direction, 'hard to employ' persons who are just learning basic job skills do not maximize labor efficiency. If any degree of labor efficiency is going to be realized, there must be very strong teachers and role models. There is still the need for more processing capacity in order to grow the program. This may be supplied:
1) by increasing the automation and mechanization of the processing (which will happen with the opening of the Madison FEED project), 2) through a vertically integrated on-farm processing facility (which will be realized by the Just Local Cooperative Processing Facility, or 3) by MMSD choosing to do some processing internally. We are feeling optimistic that these and other processing solutions will be emerging in the coming years to adequately meet the demand

if supply and price issues can be resolved.

While the challenges are many, the biggest lesson that was learned throughout the course of this grant period was that there is a very real demand and desire to have local WI produce in the Madison Metropolitan School District. Students, parents, teachers and administrators love the snack program. While there are barriers, there is clearly a very high demand and a great desire to overcome these barriers and bring more local produce into the Madison Metropolitan School District. In addition, it is apparent that while there are challenges, minimally-processing local produce can be a viable business.

VI. Additional Information

Please see the attached articles from Madison Commons and from Jaime Oliver's Food Revolution

VII. Detailed Financial Reports

Specialty Crop Block Grant FY09

Salaries, Wages & Fringe Benefits *List information on position title, salary, fringe benefits, duration, etc.*		Approved Grant Budget	Actual Grant Expenses Dec '09-Dec '11	In-Kind or Direct Support Dec '09-Dec '11
Executive Director Budgeted for 5%, actual: ,1%		4,600.00	490.69	642.47
Farm to School Program Manager, Budgeted for 15%, actual: 22%		10,062.50	5391.31	8030.04
Snack Program Coordinator, Budgeted for 30%, actual: 33.2% FTE		15,548.00	5,452.00	6,607.65
	Total	30,210.50	11,334	15,280.16

Supplies & Materials *Itemize by large categories if possible*		Approved Grant Budget	Actual Grant Expenses	In-Kind or Direct Support
Packaging supplies/hairnets/gloves, kitchen equipment, photocopies		8,666.00	8,666	700.93
	Total	8,666.00	8,666	700.930

PROJECT TOTALS	**38,876.50**	**20,000**	**15,981.09**

VIII. Contact Info:

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9) Wisconsin Potato and Vegetable Growers Association

Project Title: Marketing and Promotion of Wisconsin Grown Potatoes - A Buy Local

Total Amount Received: $45,000

Date of Award: December 1, 2009

Project Contacts: Duane Maatz

Report Date: October 27, 2010

I. Project Summary

This program is being made in an effort to assist growers in moving toward a sustainable future. Each day we read, hear and discuss sustainability in our society. Wisconsin potatoes growers have been implementing sustainable production practices years ahead of their time. It only makes sense that we promote our product within a buy local and regional market.

With the recent passage of the climate change bill in Congress, in one form or another, sustainability will have its impact on us all. Our growers have been producing within the Healthy Grown program for over 10 years and we are ready to promote this product to consumers when they are most ready to understand the larger environmental picture related to our production practices. Increasing our volume of regional sales will have a positive impact on our carbon footprint.

Our first objective is to increase the sale and consumption of Wisconsin potatoes within the state of Wisconsin. It is important to our growers that consumers understand our production practices and in turn impress upon them the importance of including our potato products as part of a healthy diet also serving a greater purpose.

The WPVGA has promoted this program in a variety of ways. We need to become more aggressive and pinpoint buyers, category managers and other decision makers by creating a program beneficial to their marketing persons and business function.

Research will be conducted regarding the perception and attitude among consumers and produce managers toward Wisconsin Home Grown and Healthy Grown potatoes. We then need to gain ground with produce managers and assist them in better understanding the consumer's informational needs to create a push / pull marketing strategy. Presentations will be made to category decision makers to explain financial advantages to marketing our products at retail.

Research will include face to face interviews in 5 distinct market areas within Wisconsin. Over 500 interviews will be conducted to determine the level of awareness and acceptance level of Wisconsin Home Grown and Healthy Grown potatoes. The promotion of Wisconsin Home and Grown and Healthy Grown potatoes has been part of the WPVGA promotional efforts for many years. Now is the time for us to move our promotional program forward toward greater quantifiable results. Our intent is to utilize this grant opportunity to provide a more aggressive and successful marketing effort than we could previously fund. We have not applied to other sources of funding for this venture.

II. Project Approach

Market Research

Perception and Attitude Research targeting retail executives with the primary focus on Wisconsin Healthy Grown® Potatoes and a secondary focus on Wisconsin Potatoes. Twenty high level retail executives were contacted via telephone. The names of the interviewees were obtained through the assistance of Wisconsin potato grower/shippers. The interviews were 30-60 minutes each. The goal of this research was to acquire a better understanding of the perception retail executive have of Wisconsin Healthy Grown® Potatoes and Wisconsin Potatoes in general. Results of the research have been used, and will continue to be used, to help develop effective marketing strategies that sell more Wisconsin potatoes in Wisconsin and beyond.

Note: Initially this research was going to directly target Wisconsin consumers via face-to-face interviews to determine their level of awareness and acceptance level of Wisconsin Potatoes, and Wisconsin Healthy Grown® Potatoes. But after discussions between WPVGA Promotions Committee members and Thomas Marks & Associates staff (WPVGA's advertising agency), we decided the most useful information would come from retail executives (potato shipper's direct customers).

Results: One of the most significant findings was that retail executives feel they aren't getting enough support from produce suppliers for point-of-purchase (POP) material. Having insight into these needs has helped the Wisconsin Potato & Vegetable Growers Association (WPVGA) develop new Healthy Grown® POP material for grocery stores. This new POP has been developed and will be tested in approximately 10 Wisconsin grocery stores.
A copy of this market research study is attached.

Wisconsin Healthy Grown® Potatoes – Point-of-Purchase Retail Test

The point-of purchase (POP) retail test is intended to test the effectiveness of Wisconsin Healthy Grown® POP material in grocery stores. The POP material that has been designed and produced includes posters, recipe tear pads, balloons, price cards, and "floor talkers" (vinyl posters adhered to the floor).

We are in the process of finalizing store locations and coordinating logistics to be able to implement the test. There will be between 5-10 stores involved in the test. These stores are being procured through the efforts of Wisconsin Healthy Grown potato shippers. The goal is to have at least one store in each of the five major media markets in Wisconsin (Milwaukee, Madison, LaCrosse/Eau Claire, Green Bay/Appleton, and Wausau/Rhinelander).

The total period of this test will be six weeks. The first three weeks will include Healthy Grown® Potatoes without POP material to determine baseline sales data. This will be followed by three weeks with all POP material. After the test is completed, a report will be generated to summarize the results of the test. If the results indicate a statistically significant increase in sales using the POP, a case study will be prepared explaining the benefits of using Healthy Grown® POP.

The case study will be provided to Wisconsin potato marketers and used as a sales tool with the target audience being produce buyers and retail executives. The ultimate goal is be able to offer Wisconsin potato shippers proven, effective point-of-purchase material that will help increase sales of Wisconsin Healthy Grown® potatoes.

Results: The point-of-purchase material has been developed and is available for shippers to use. The point-of-purchase retail test will be conducted in early 2011.

Win With Wisconsin Potatoes – Season Recipe Contest

This promotion consists of five separate seasonal recipe contests:

1) Holidays (Thanksgiving/Christmas)
2) Spud Bowl 2010 (football parties/tailgating)
3) Saint Patrick's Day
4) Easter
5) Summer Entertaining

A "microsite" (www.WinWithWisconsinPotatoes.com) was designed and used as the central hub of the promotion. There were two main targets for this promotion: 1) Consumers (both within Wisconsin and nationwide) and 2) Industry Professionals (produce buyers, produce managers, retail executives).

The main methods for reaching these target audiences included 1) E-mail blasts to consumers using the WPVGA's database of over 5,000 names 2) Retailer e-mail blasts to hundreds of produce buyers/managers and other industry professionals; 3) Consumer and trade press releases sent to a wide variety of print and electronic media. Press releases announced the new contest and a separate release announced the winning recipes. Each version of the release (consumer/trade) had a message tailored to that audience. Web searches were also a valuable tool in attracting interest in the contests. Several of our contest entrants learned about our contest(s) through recipe contest websites. These websites learned of the contests via our press releases.

Consumers were directed to go to www.WinWithWisconsinPotatoes.com to enter their recipe for the current contest. They could also go to the site to find other recipes and check out the winning recipes. There was also a link to www.wisconsinpotatoes.com to drive traffic to the WPVGA website.

Once the three winning recipes (Prizes: 1st = $150, 2nd = $100, 3rd = $50 grocery store gift cards) were selected, professional photography was taken of each dish. All three pictures were used on the website. Additionally, the 1st place recipe was used to create recipe tear pads to be

used by grocery stores as in-store point-of-purchase (POP) material. A POP poster was also designed. These materials were available to retailers via the microsite.

Results: There have been over 300 recipes entered in all contests.. Win With Wisconsin Potatoes press releases have generated a considerable amount of free press promoting Wisconsin potatoes. A summary of Web traffic statistics are attached to this report. Grant funds were not used to pay for contest prizes.

Public Relations

An important part of generating consumer awareness and demand for Wisconsin potatoes is effective public relations. The WPVGA had a total of 16 press releases.

1. Pairing Two Wisconsin Icons – Harleys and Potatoes (consumer & trade version)
2. 68,000 Acres of Wisconsin Potatoes and All is Well Despite Late Blight Fungus
3. More Than $1,500 to be Awarded to Culinary Contest (consumer & trade version)
4. Potatoes: Not Just a Side-Dish Anymore
5. Which Potato for Which Dish? Type Matters
6. Potato Pizza Scores Big in Spud Bowl 2010 Recipe Contest (consumer)
7. Produce Departments Can Score Big with Customers During Football Playoffs (trade)
8. Wisconsin Whole-Farm Potato Growers Make Strides in Conversation and Sustainability
9. You Shouldn't Have to Pay More for Eco-Friendly Produce
10. Irish Flair for Wisconsin Potatoes (consumer)
11. Boost St. Patrick's Day Sales with Free POP and Wisconsin Potatoes (trade)
12. Wildlife, Cranes, Potatoes – Preserving Threatened Ecosystems One Farm at a Time
13. Easter POP Gives Consumers A Mix of Chocolate and Mashed Potatoes (trade)
14. Who Would Think Chocolate and Mashed Potatoes Could Taste So Good? (consumer)

These releases were picked up by a variety of media and on-line publications. See attached for sample articles.

Web Audit

An analysis of the functionality of our www.wisconsinpotatoes.com website was performed by TMA + Peritus of Wausau. This analysis was done to help the WPVGA better understand how to effectively promote Wisconsin potatoes via the internet. A copy of this report is attached.

Results: The WPVGA has learned that the www.wisconsinpotatoes.com website is difficult to navigate and takes multiple clicks to find the desired information. Also, the cost to fix the navigation problems will be significant enough that it has been decided to develop a new industry website and a new consumer website. Having two websites will allow the WPVGA to focus our message on the specific target audience (consumers/industry) and more effectively promote Wisconsin potatoes.

Spudster Sweepstakes - Direct Mail Promotion

The WPVGA implemented a direct mail campaign that targeted produce buyers throughout the U.S. - predominantly on the eastern half of the country. Wisconsin potato shippers provided the WPVGA with a list of their best customers, 231 buyers in total. Via monthly mailings, e-blasts, and promotional gifts, these buyers were encouraged to visit the www.wisconsinpotatoes.com

website to enter for a chance to win a Wisconsin themed, custom-painted Harley-Davidson motorcycle, affectionately called the "Spudster".

Once at the website they used the log-in and password they received on the mailing to enter for a chance to win the Harley and monthly prizes (gift cards of $150, $100, and $50).

Results: Based on the percentage of produce buyers entering the contest, the promotion was a success. The percentage of produce buyers logging in varied from month to month between 17-25%. Although having buyers go to the website was only part of the benefit of the promotion. Shippers also found that the monthly gifts built good will with their customers and helped keep "Wisconsin" top of mind with buyers and helped sell Wisconsin potatoes. Grant funds were not used to pay for promotional gifts.

III. Goals and Outcomes Achieved

Market Research

Perception and Attitude Research targeting retail executives with the primary focus on Wisconsin Healthy Grown® Potatoes and a secondary focus on Wisconsin Potatoes has been completed and will continue to guide us in developing retail marketing tools such as point-of-purchase material. The goal of this research to gain a better understanding of the perception retail executive have of Wisconsin Healthy Grown® Potatoes and Wisconsin Potatoes has been accomplished. It will help develop future marketing programs that match retailer needs.

Wisconsin Healthy Grown® Potatoes – Point-of-Purchase Material Development and Tesing

The point-of purchase (POP) material has been developed. The goal of developing POP has been accomplished. Retail testing of this POP to measure its effectiveness still needs to be conducted (testing planned for early 2011).. The POP material that has been designed and produced includes posters, recipe tear pads, balloons, price cards, and "floor talkers" (vinyl posters adhered to the floor). The long-term goal is to continue to provide this material to shippers to enhance sales opportunities with retailers.

Win With Wisconsin Potatoes – Season Recipe Contest

The five recipe contests have been completed and provided the WPVGA with over 300 new recipes for our website. It helped us raise consumer awareness of Wisconsin potatoes.

The newly developed website www.WinWithWisconsinPotatoes.com continues to be used to help raise consumer awareness through the implementation of new recipe contests.
The goal of developing press releases to generate free press promoting Wisconsin potatoes has also been accomplished.

Public Relations

Public relations efforts have met our goal of raising awareness of Wisconsin potatoes with consumers and industry professionals through a variety of articles (print and on-line) focusing on our marketing efforts, contests, and other promotions

Web Audit
The goal of using a web audit to help us develop 2 new websites has been met. The WPVGA will unveil the new websites in early 2011. These websites will be instrumental in delivering WPVGA's consumer and industry messages. Grower communications and consumer interaction via these websites will be critical to selling more Wisconsin potatoes.

Spudster Sweepstakes - Direct Mail Promotion
The goal of interacting with produce buyers throughout the U.S. - predominantly on the eastern half of the country was accomplished through the implementation of the Spudster promotion. Via monthly mailings, e-blasts, and promotional gifts, we were able to interact with produce buyers and raise the profile of Wisconsin potato shippers.

Based on the percentage of produce buyers entering the contest, the promotion was a success. The percentage of produce buyers logging in varied from month to month between 17-25%. Requiring buyers to go to the website to sign up for their chance to win helped increase awareness of our website and generated website traffic.

All these efforts were effective in increasing sale of potatoes under the Healthy Grown label by slightly more than 10%. There was an increase in potatoes grown for this label from 2008 to 2010 by more than 10%. While we are excited about this increase, we will continue to advance our efforts in marketing the Healthy Grown label and hope to possibly include other vegetables besides potatoes in this campaign in the future.

IV. Beneficiaries
All Wisconsin potato shippers (and indirectly, growers) benefitted from the marketing programs implemented through the availability of the Specialty Crop Grant. Shippers such as Alsum Farms & Produce, RPE, Bushmans', Inc., Okray Family Farms, and Spud City Sales are all heavily involved in the WPVGA's marketing efforts and all benefitted from the raised awareness (consumer and industry) generated by the above marketing programs.

V. Lessons Learned
One of the main things we learned was that although retailers want point-of-purchase materials for their grocery stores, it is often difficult to implement at the store level. The multiple organizational levels in the retail industry make it a challenge to get POP in stores. We also found that it is easier to generate industry PR than it is consumer PR.

Overall, we learned that to significantly increase consumer and industry awareness and sales of Wisconsin potatoes, you need to have a long-term vision of the right mix of marketing programs. Additionally, it is important that these programs complement each other so you can develop a multi-pronged approach to reaching your customers.

VI. Additional Information
None

VII. Detailed Financial Reports

All $45,00 was paid to TMA Services for their development of the market research and promotional campaigns. No grant funds were used for prizes for any of the contests.

VIII. Contact Info:

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10) McKay Nursery

Project Title: Evaluation of Unique, Newly Bred Selections of Trees for the Midwest Urban Environment

Total Amount Received: $31,118

Date of Award: December 1, 2009

Project Contacts: Tom Buechel

Report Date: October 31, 2012

I. Project Summary

Increasing the genetic diversity of the trees used in our urban landscapes is a well-recognized need, especially with the impending impact of the loss of major tree genera (ash in particular) due to stresses (such as the emerald ash borer). In an effort ancillary to a tree breeding program at the University of Wisconsin-Madison, populations of hybrid maple and alder have been generated that promise to combine a high tolerance to urban street stresses and a low or no potential for invasiveness. This project was organized in four distinct phases, three during the grant period and the fourth post-grant: propagation of selections from the hybrid populations to generate a clonal population suitable for evaluation; growing these plants to appropriate size and quality for use in urban street plantings; plant as replicated test populations in street environments in several Wisconsin communities; and to evaluate the selections for suitability and lack of invasiveness followed by release of the top performers for production in Wisconsin and utilization in urban settings throughout the Midwest (post-grant).

II. Project Approach

Maples: Pre-award: Fourteen maple selections were bud-grafting in August, 2009 by a MdKay Nursery subcontractor, Speer and Son Nursery of Woodburn, OR. Twenty-five bud-grafts were performed for each selection with the goal of obtaining at least 20 replicates of each of the 10 best clones.

In 2010 a total of 298 bud-grafts were successful, with an average success rate of 85%, ranging from 72% for clones #1 and #11 to 100% for clones #2 and #4. These trees were grown-on during the 2010 season. The staff of Speer and Son nursery were impressed by the appearance and growth of these selections. The totals for each clone were above the target numbers for Goal 2.

Alders: Pre-award: Thirty cuttings from each of four alder selections were taken on 8/11/2009 and stuck at McKay nursery. These cuttings rooted poorly, resulting in the need for cuttings to

be taken in 2010. This delay in the propagation of alders did not interfere with the accomplishment or timing of Goal 2.

In 2010, a total of 165 cuttings were collected from the 4 selected individuals on 6/3 and 6/13. These cuttings rooted with an average success rate of 90%. The totals for each clone were above the target number for Goal 2. This established a viable protocol for the rooting of cuttings from these clones.

Two-hundred twent-one of the original 298 bud-grafted maples grown during the 2010 season at Speer and Son nursery in Woodburn, OR were shipped to McKay Nursery. These maples were potted into Proptech Light Pots fabric containers and grown at McKay Nursery during the 2011 and 2012 growing seasons. The 154 alder cuttings rooted at McKay nursery in 2010 were potted into the same containers as the maples and grown at McKay Nursery during the 2011 and 2012 growing seasons. This study demonstrated the usefulness of these fabric containers, which are relatively new to Wisconsin nurseries.

Dr. Hoch collected phenotypic data on the clonal replicates at McKay Nursery and on the original plants in the test plots, and determined the identification of the seven clones that either were miss-labeled or had lost tags during the transport from Speer and Son nursery. In addition, he began evaluating the sterility of the adler clones. Seeds were produced for the first time on two of the original selections at the Arlington test plot. Under controlled laboratory conditions, none of these seeds germinated, which is consistent with flow cytometric data indicatin that these clones are triploid, and are therefore likely to be highly sterile. He also began evaluation of the fertility of the maple clones, which flowered for the first time in 2012. Initial results for the maples will be known in the spring of 2013.

Meetings took place in January of 2011 and 2012 with the advisory committee and the State Urban Forestry Coordinator, Richard Rideout, to organize selection of the cooperating municipalities/urban foresters. Planting site evaluation and selection protocols were written by Dr. Hoch and were reviewed by Mr. Rideout and the cooperating urban foresters.

The trees will be planted in the urban test sites in the spring of 2013, rather than the originally planned fall of 2012. This will allow for th etrees to complete the full season of growth in the nursery and increase the survival rate of the alders, which are more successful when transplanted in spring. The project will exceed the numbers set out for Goal 3 (3 urban street sites in 2 Wisconsin communitites), as replicated plantings will be placed into six Wisconsin communities. Trees will be planted in one community in each of the six Wisconsin Urban Forestry regions: North Central Region, village of Port Edwards; Northeast Region, City of Menasha; East Central Region, City of West Bend; Southeast Region, City of West Allis; South Central Region, City of Lodi; West Region, City of Eau Claire.

III. Goals and Outcomes Achieved

Goal 1. *Propagation of selected clones*, was achieved on schedule during 2010. Propagation of maples and alders took place during 2009 and 2010.

Goal 2. *Growing these plants to appropriate size and quality for use in urban street plantings*, was achieved during 2011-2012. Trees were grown in fabric containers at McKay Nursery during the 2011 and 2012 growing seasons.

Goal 3. *Plant as replicated test populations in street environments in two Wisconsin communities*. The trees will all be planted in the urban test sites in the spring of 2013, rather than the orginally planned fall of 2012. This will allow for the trees to complete the full season of growth in the nursery and increase the survival rate of the alders, which prefer to be transplanted in spring.

Goal 4. (Post-grant). *Evaluation of the selections for urban suitability and lack of invasiveness*. These tasks will take place over the next six years, culminating in propagation of the final selections in anticipation of their release to the nursery industry.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Goal 1. Propagate 10 selections of hybrid maples and 2 selections of hybrid alder: A total of 14 maple and 4 alder4 selections were propagated on schedule.

Goal 2. Grow propagated selections to plantable size and quality: A minimum of 15 clonal replicates of each selection were grown to the target size range of 1.5 to 2 inch caliper.

Goal 3. Plant trees in a minimum of 3 urban street sites in 2 Wisconsin communitites: As indicated above, all trees will be planted into urban street sites during spring 2013. Trees will be planted in multiple sites within each of 6 cooperating communities.

IV. Beneficiaries

Increasing the density and diversity of urban forests is critical to maintaining a vibrant and livable urban environment, and therefore affects virtually every urban citizen in Wisconsin. Wisconsin's urban forests annually store over 2 million tons of carbon, (equivalent to the emissions of five and one half 200 megawatt power plants), remove thousands of tons of air pollution, reduce heating and cooling expenses and improve the mental health of urban dwellers. Statewide, urban communities are under increasing stress and threats in trying to maintain suitable and environmentally beneficial tree densities. Potentially, every urban street tree program and urban community citizen will be impacted by this project.

In addition, the more than 700 Wisconsin nurseries and over 2000 other business involved in the planting and maintenance of urban trees will benefit by having a wider range of selections as well as superior performing trees. It is estimated that the longevity of most urban trees is less than 10 years, and the cost associated with urban tree removal and replacement are dramatic. Thus, increasing the health and longevity of urban trees greatly reduces costs to municipalities and home owners. For example, the estimated costs for removing and replacing urgan ash trees in Wisconsin following devastation by the emerald ash borer are estimated to be over $3 billion dollars.

V. Lessons Learned

While the primary outputs of this project will result from the completion of Goal 4 (post-grant evaluation of the selections for urban suitability and lack of invasiveness), several lessons have resulted from the projects' activities to date. First, a protocol was developed for the efficient asexual propagation of alder hybrids. Also, this study demonstrated the utility of the Proptech Light Pots fabric containers that were used at McKay Nursery for the first time on this project. The containers, which are relatively new to Wisconsin nurseries, produced a root system that was far superior to standard plastic containers, and should result in increased transplant success next year. Finally and possibly most importantly, we were surprised by the enthusiastic response of the Wisconsin urban foresters. Many more communities responded than were expected, and we had to narrow the list down to just six communities, one in each Wisconsin Urban Forest region. This suggests that the system used in this study may serve as a model for future projects involving street tree development and/or evaluation.

When this project was originally planned, we did not consider all of the potential challenges of working with experimental organisms and the potential impact of weather-related issues, such as an extremely dry planting season. In planning such projects it may be beneficial to incorporate additional short-term outcome measures that will be unaffected by the vagaries of the study organism or weather. As this can be extremely difficult, it may be helpful to at least be aware of changes that may occur and keep the granter aware of issues affecting the achievement of your original timeline.

VI. Additional Information

None

VII. Detailed Financial Reports

	Expenses
Contractual:	$7934
Dr. Hoch's services	
Other:	
Production of Maples	$8765
Production of Alders	$1603
Planting of trees	$12,816

VIII. Contact Info:

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11) Wisconsin Grocers Association Inc.

Project Title: Wisconsin Buys Local: Tomatoes-Apples-Potatoes

Total Amount Received: $30,400

Date of Award: December 1, 2009

Project Contacts: Brandon Scholz

Report Date: December 13, 2012

I. Project Summary

This project enhanced and updated the Grocers Buy Local resource website with an original focus on apples, tomatoes and potatoes. Further updates to the site included wholesale supplier/ distributors to further assist farmers and growers in expanding their ability to reach these supply chain contacts. The project also supported the work completed through the 2007-2008 Risk Management Grant - Accessing Local Markets: Buyer/Seller Connections, the Key to Success. Accessing Local Markets surveyed Wisconsin grocers carrying local foods to establish a process that producers should follow to work with them.

The project also focused on the continuing development of the www.EatAtHomeWi.com website which provided consumers with resources to do meal planning and grocery shopping tied in to identifying local products and healthy eating. The project, with dual emphasis on the retailer/ farmer/grower and the consumer raised awareness to strengthen the "buy Wisconsin" economy that will continue to grow as consumers and producers utilize the EatAtHome site. Grocer industry reports suggested that as consumers become more aware of the value of locally grown products, sales of these products would grow and become more of a consistent factor in the perishable and value added categories.

When we started this project, ongoing feedback from the grocers was that there was a serious lack of sufficient local product volume to meet customer purchasing demands. By updating the Grocers Buy Local website to emphasize tomatoes, apples and potatoes, hundreds of grocers across the state will provide information to growers and farmers about the interest in these and other local products. Adding in the information on wholesale suppliers and distributors is now providing additional outlets for producers to move their products, thanks to this project.

With the development and launch of www.EatAtHomeWi.com consumers are able to find their local grocer and with the information from the different components of the resourceful website, incorporate the nutritional aspects of tomatoes, apples and potatoes, and other healthy products into their purchases. Lastly, an anticipated benefit of this project was increased job opportunities throughout the supply chain.

II. Project Approach

The initial project was to establish a baseline of inventory and "inventory turns" on apples, tomatoes and potatoes, regardless of origin, to help supplier partners better understand the current retail demand as well as assist suppliers in understanding demand levels for local products. Growers and processors would then be able to use the data to plan for additional production. Through retail positioning, the project would build a sustainable and profitable market for value added and perishable local products in these three specialty crop categories, resulting in a stronger "buy Wisconsin" supply network. We worked on the following activities to move forward with this initial project but had

- Develop baseline report of all three commodities identifying in-state versus outstate of the three named specialty crops.
- Determine current retail market share at store shelf level meeting with grocers to assess levels and review inventory and database software.
- Solicit sales and inventory data with multiple requests.
- Develop reporting and data collections materials.

Many attempts were made to gather sales and inventory data from retailers to create the baseline report and determine retail market share. Due to the lack of participation by grocers for many reasons, only partial information was obtained for these activities so reporting and data collection materials were scrapped and the project was redirected to enhance the buy Wisconsin" supply network by updating the Grocers Buy Local resource website and the www.EatAtHomeWi.com website.

To proceed with updating the Grocers Buy Local website, the original approximately 175 grocery retailers included on the original site were contacted by phone and asked to participate in a survey that had additional specific questions relating to the specialty crops. Approximately 150 additional grocers were contacted by letter/phone follow-up to also participate in the survey. The addition of more grocers to the site would potentially create a broader opportunity for growers and retailers to do business. An additional 50 grocers successfully completed the survey and were added to the site.

The commodities components were included in the survey and are incorporated through the website. They will be continued to be highlighted in each of the referenced sections on the site. These commodities will always be heighted even as other nutritional items are added to the site. The formatting of each section maintains the rotation of the four pages in each section and allows us the ability to either keep the current information or update/replace with new information as needed.

The site was also enhanced to be more user-friendly by including additional relevant industry related links; an option for retailers to register their location on the site as well as update current information; additional contact information for retailers is also included.

We worked closely with the trademarked Something Special From Wisconsin program so that we did not need to survey wholesalers on our own. This program works with local Wisconsin companies doing wholesale and retail business so we were able to obtain opinions and information through this program to incorporate into the Grocers Buy Local website.

Social media partners were used to develop strategies for the site and to help the WGA develop plans to promote the site using Facebook, Twitter and other means. Social media outreach will

continue implementation with WGA members who are also on the site under Find Your Local Grocer. They will be asked to link and friend Eat At Home Wisconsin. Thought-Tech provides strategic direction, messaging and content designs and continual review of the site to help drive traffic to the site.

As a result of the additional surveying of stores, an additional 50 retailers were added to the 175 existing stores; an increase of 70%. The goal was to have an additional 25 store locations added to the site. It is hoped that the improvements and additional information added to the Grocers Buy Local site will expand/enhance the relationship between farmers/growers and retailers by providing a more direct opportunity for communication.

The new/enhanced Grocers Buy Local site was just recently launched, so surveying stores to see if sales have increased will occur in 2014.

The Eat at Home WI website was just in its initial stages at the launch of this phase of the project. It has been populated with grocery shopping, meal planning, healthy eating, and farm to fork sections which have four additional areas within those sections. Recipes, shopping tips, seasonal information and other topics and activities under each section are updated on a continual basis.

Surveys were conducted to help determine the site content. Data was gathered form grocers and consumers, entered into a spreadsheet and uploaded to the site. Existing information was merged with the new information from the surveys.

All of the information on the Eat at Home site was verified, including the details and contact information on the "Find Your Grocer" page. *Thought Tech* established standards for current and future content and developed a writing platform to keep content consistent throughout the site. Prior to launch, Thought Tech verified all content for placement and accuracy as well as assuring there was balance afforded to the commodities versus the other content on the site.
In addition to social media, the site will be promoted through the WGA's electronic and print communications to members encouraging them to promote the site on their customer driven websites. The WGA does media announcements, interviews and promotions alerting consumers to the site. The WGA will continue to partner with the state health department, the University of Wisconsin and other entities involved in promoting healthy issues and nutrition. The WGA has also partnered with commodity organizations such as the WI Potato and Vegetable Growers Assn, Wisconsin Apple Growers Assn, buy local groups, etc to help promote and push the site to engage consumers.

Both sites are being promoted through the WGA's weekly e-newsletter, on the WGA website as well as in print publications.

The Eat at Home site recently went live so we are planning quarterly web assessment to determine visits/hits to the site as well as conducting "pop up surveys", etc. thru social media connections. We will use the results of these surveys and assessments to gauge the success and direct the nature of the site updates with each assessment.

III. Goals and Outcomes Achieved

Goal 1*: is to increase retail sales of fresh and value added tomato, apple and potato products offered by grocery retailers across the state.*
Performance Measure*: The WGA will survey retail grocers asking for information on the current use of the targeted commodities and anticipated use for the upcoming year.*
Benchmark*: No data currently exists on how the site has promoted local WI specialty crop sales.*
Target*: 1) Increase site listing updates by 90%* : We successfully increased our listings more than 90% from the old site. We are very excited about the quantity and quality of the new site information. We feel it is now robust enough to draw producers, retailers and wholesalers to the site and help them connect to eachother.

2) *Increase listings by 25 grocers:* We exceeded this target 100% and were able to increasing our listings by 50 grocers!

3) *20% of retail grocers surveyed will report increased sales of tomatoes, apples, potatoes and other Wisconsin specialty crops through the help of the Grocers Buy Local Website:* The site has only been live for a few months so we decided not to survey retail grocers until 2014 but our contacts with retailers about the site has been extremely positive and we believe we are on track to exceed this target.

Goal 2*: increase consumer awareness of healthy specialty crops through www.EatAtHomeWi.com by providing resources and information on healthy eating, meal planning and grocery shopping.*
Performance Measure*: Will do a quarterly website assessment for www.EatAtHomeWi.com to determine how many web viewers are using the meal planning, shopping resources and the specific pages and links related to the three targeted commodities. The WGA will incorporate consumer surveys using 'pop-up' surveys after consumers use the site or download information. Consumer opinions and website value will also be collected through social media connections scoring feedback from consumers.*
Benchmark*: Currently there is no data to establish a benchmark since this site is not in operation.*
Target*: 50% of website users will use meal planning and shopping resources to develop greater skills in shopping for, and using tomatoes, apples, potatoes & other healthy Wisconsin specialty crops.* The site was launched at the end of our grant period so we have not had time to survey our site users but we have gathered information in the first month of the site launch that leads us to believe we will easily exceed our target for web users. In the first month the Eat at Home website had 1000 different people visit the site. On average, each visitor viewed 3 pages with the shopping and meal planning pages being extremely popular. We are working with our web development company to implement the pop-up surveys and anticipate that users will feel the menu planning and shopping pages were useful based on the site popularity and length of site visits, as well as feedback from an initial 20 users during a soft launch. We have also launched our facebook and twitter accounts for the eat at home site and are pleased with the likes and feedback.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.
See above in part A.

IV. Beneficiaries

The project has increased the awareness of the grocery retailers on pricing, supply, and quality of these specialty crop products. By increasing retailer awareness of the product supply, supported by the use of store level signage, consumer awareness of availability and benefits of these specialty crop products is heightening. This will drive increases in retail sales, production, value added product manufacturing and distribution. Incremental growth in retail sales will eventually serve to displace similar out-of-state and out-of-country products. The Wisconsin Grocers Association has 360 members who have and will continue to benefit directly from this project along with farmers and other producers who have engaged with the grocers on the Grocers Buy Local Website. 1000 consumers benefitted from the Eat at Home website in the first month it was launched and we anticipate this number to greatly increase over the upcoming months as we focus social media compaigns to drive more and more people to the site. Consumers will be able to find their local grocer and with the information from the different components of the resourceful website, incorporate the nutritional aspects of tomatoes, apples and potatoes, and other healthy products into their purchases.

Lastly, an anticipated benefit of this project is increased job opportunities throughout the supply chain.

V. Lessons Learned

Grocery retailers and wholesalers continue to report that consumer education and a strong partnership between the retailer sector and the producing sector are critical for growth in the buy local category. Equally important is the continuing education of consumers who need to build local products into their shopping trips to the grocery store.
A vast majority of the stores surveyed offer many local products, including apples and potatoes. The updated information on the website continues to put grocers in touch with local producers and provides production planning tools to specialty crop growers.

VI. Additional Information

None

VII. Detailed Financial Reports

Salary/fringe	$23,625.60	
Contractual	$6420.79	Accent Graphics and SnowShoe designs (web companies)
Other	$353.70	Postage and parking

VIII. Contact Info:

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12) Wisconsin State Cranberry Growers Association

Project Title: Cranberry Energy Conservation Program

Total Amount Received: $16,500

Date of Award: December 1, 2009

Project Contacts: Tom Lochner, Executive Director

Report Date: November 26, 2012

I. Project Summary

The main effort of the project was to promote energy conservation within the Wisconsin cranberry industry, and investigate opportunities for energy conservation efforts on Wisconsin cranberry acreage. Growers faced with high energy costs in operating the marsh are asking for help in reducing these costs and adopting new initives toward energy conservation.

The Wisconsin cranberry growers have been working on creating more sustainable practices for many years with concerted efforts to make significant strides over the past 20 years. Water conservation has become a huge concern in northern and central Wisconsin along with greater consumer awareness of sustainable farming practices. These consumer focuses along with continually rising energy costs prompted growers to push for research on renewable energy practices that could be adapted for cranberry marsh operations. The original focus was on solar and wind energy because they are the two renewable energies with the most recognition and public information nationally. However, as this project began, hydroelectric power became an obvious choice to include in the focus because of the practices of moving water in and out of cranberry beds during different times in the growing process and the shear quantity of water cranberry growers access. This project evolved some during its three years but it started because growers wanted practical information about renewable energy for their cranberry production and ended with positive results to help growers find useful renewable option and even a few wind, solar, and hydroelectric power installations.

II. Project Approach

Major goals of this program included a strong educational effort to inform growers, as well as on-site pilot projects to show growers what can be done. Educational efforts included numerous news articles and newsletter contributions that were distributed to growers and associate members at the rate of app.10-12 articles during the period of the grant. Coverage was app. 400 per each newsletter for the period. Educational information in the form of brochures were completed on several occasions, with distribution to the annual "Growers School", and Summer Meeting. Distribution of 350-400 at schools, and 1000-1200 at summer activities provided for excellent coverage to growers and associate members, as well as general public. On-site projects

took the form of Hydro-electric and Wind Tower projects. During the period, two wind towers were erected, and one hydro-electric system was activated. In addition, 2 wind systems and two to four hydro systems are in the planning stages. Currently we do have several active interests in the development of "Solar-Water" pumping systems. Further research on these renewable energy options will continue as funding becomes available and efforts will continue in assisting growers in adopting these new technologies.

To facilitate the project, we developed a Cranberry Energy Working Group. Group members were selected based on what assistance they could bring to the table in recognizing the potential needs of cranberry growers, and what potential alternative energy applications that would be appropriate for cranberry production. Lots of outreach was happening at the same time so growers would be aware of energy options and opportunities to become involved.

The initial project had Focus on Energy performing audits for marshes to help assess their energy consumption and determine what if any alternative energy would be feasible for each one. Unfortunately, shortly after the audits began, Focus on Energy lost their federal funding so only a small number of sites received the audits and the energy audits performed by Focus On Energy were not shared with us as originally planned. So additional outreach efforts were implemented to share ideas for potential projects with growers. Direct contacts to growers showing interest, newsletter and program presentations explaining the efforts were all used to help select participants for the pilot projects. All interested growers and sites were reviewed by working group. All sites were viewed and potential systems determined through Engineering plans developed by professional engineers and final selections were made for the pilot projects. Materials and production cost estimates were included in the engineering plan documents for each of the projects. Growers retained the records on actual production expenses, but because there was so much difficulty in the original stages of this project in obtaining information from Focus on Energy on their audits they performed, we are now working with growers that have installed systems to review and analyze the impact from their systems after 6-12 month periods or where data is available.

There have been considerable efforts made to share information on all the pilot projects and other potential energy opportunities with growers. Several on marsh workshops were held at various stages in each project's development. These efforts were as small as 5-10 growers in an informal discussion group on several occasions, to a formal program of 40-50 attendees consisting of growers, agency personnel, utility representatives, engineering reps, etc. Presentations were held at the annual Wisconsin State Cranberry Growers Association/UWEX Summer Meeting and Field Day Summer Meeting the second week of August on a pre-determined grower marsh. The Association estimated attendance for these events was 1100 in 2012, and 1300 in 2013. The alternative energy workshop had 65-75 attend in 2012, and 80-100 participants in 2013 with several serious inquiries resulting from each workshop effort. A staff member and electrical engineer knowledgeable in solar and hydro systems gave presentations to the groups. Additional presentations were made at WSCGA/UWEX Wisconsin Cranberry School held annually the third week of Janurary. The sessions in 2012 and 2013 welcomed nearly 450 participants, each year. In both sessions, printed document and program presentations were made to the entire group. Agency and Association personnel provided the grower contact materials, covered the various alternative energy options, as well as discussing grower adoptions of Hydro Electric and Wind systems on marsh sites in the state. Overall this project was

extremely successful and continues to gain interest by growers on a daily basis. We feel this funding has truly made an impact on both energy cost reduction and increased both environmental and economic sustainability of grower operations. It was extremely valuable the WSCGA as a whole and to individual growers throughout the state and possibly the nation as information is shared nationally.

III. Goals and Outcomes Achieved

It was estimated that we would conduct 12 cranberry marsh assesments to evaluate potential solar and wind adoption on the marsh. To date, 4 wind systems have been completed but less interest has been shown for adoption of solar systems. Approximately 20 marsh contacts have been made to date to encourage the adoption of wind and solar systems. With efforts from FOE, more than 40 marsh sites were evaluated for energy conservation. Without input on electrical usage on these sites, we were unable to attempt to adopt alternative energy use systems on these sites. Attempts to reach 8-10 sites to encourage some form of Hydro-Electric utilization have resulted in one system on-line and 4 on the drawing board for spring 2013 movement. One existing hydro system has the capability of producing 130,000 KW

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

With the wind tower efforts, it was anticipated that 2-4 systems would be put in place. To date, 3 systems were constructed with a potential for 2 more in the near future. At the onset, little expectation occurred with the hydro-electric efforts. To date however, one system is operating and returning surplus energy to the utility. Four additional sites were engineered and at least two appear to desire to move forward on systems for their location. Solar, while not supported well by data from FOE, is now beginning to show additional grower interests covering use for frost protection systems, water pumping, and shop energy use. Future efforts need to be addressed in this area.

IV. Beneficiaries

Newsletter exposure to the grower group typically resulted in coverage of 3-400 for each effort. Grower schools resulted in exposure to 350 growers and another 100 associate members on an annual basis. Summer meetings and educational presentations reached in excess of 1000 growers, general public and associate members on an annual basis.Annual economic impacts of the existing systems range from$10, 000 to$15,000.

V. Lessons Learned

Providing up-to-date educational information did not necessarily insure adoption by growers. Multiple visits, explanation of efforts and the use of pilot projects secured adoption. Growers, while interested in the economic impact of the efforts, were slow to adopt a system on their marsh. Once a grower adopted a system, multiple grower interests developed. Need to strike a mid-line approach between education and commercial pressure that growers receive.

VI. Additional Information

Several potential applications utilizing solar have come about due to our efforts. Electronic Start-Up systems to power frost protection and moisture monitoring seem potentially feasible. Several growers have expressed interest in these applications. Alternative wind tower applications developed in Florida have shown interest by several growers. Potential development of water-pumping systems driven by solar panels and electrical pumps are emerging. Several inquiries into low-volume water pumps tied to hydro-electric systems have surfaced. Research into available equipment needs to take place. Relationships with growers producing electrical energy destined to go to the utility have developed issues concerning limits the utility places on the grower. There is a need to work with the utility and state regulators to see if these issues can be addressed. Growers are being required to "burn off" extra energy being produced when they reach a maximum level the utility agreed to take. This is a waste of a resource and needs attention. Exposure to various "Agency" personel has resulted in an improved appreciation for our alternative energy efforts. Several commercial firms have surfaced that show interest in developing various technologies that might be adaptable to our efforts.

VII. Detailed Financial Reports

Funds available were utilized consistant with the amended budget.

Contractual:	$10,000	Salary for Program Coordinator
	$5000	Site assessment/plan development for demonstration projects in hydro and wind
Other:	$1500	printing costs for brochures and materials for education sessions/on-site Demonstrations
Total:	**$16,500**	

VIII. Contact Info:

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13) WI DATCP Bureau of Trade Practices -- Fruit & Vegetable Inspection Unit

Project Title: GAP/GHP Cost Share Program

Total Amount Received: $25,000

Date of Award: December 1, 2009

Project Contacts: Jeremy McPherson

Report Date: March 18, 2011

I. Project Summary

The purpose of this project was to to promote and provide food safety assistance to Wisconsin-based speciality crop producers and processors through the Good Agricultural Practices / Good Handling Practices ("GAP/GHP") certification program. The DATCP Bureau of Trade Practices -- Fruit & Vegetable Inspection Unit is authorized by USDA to certify farms and facilities under the GAP/GHP program. A key part of the certification process is an on-site audit. This grant provided funds to make these audits (and therefore, certification) financially accessable to more producers and processors, thereby creating new market oppertunities for Wisconsin producers. Many large chain stores require food safety certification at the farm level.

The GAP/GHP requirements are governed by USDA. USDA establishes the standards and trains the state inspectors who are certified to conduct the audits. USDA also mandates that the price of the audit is $92.00 per hour (plus an overhead fee of $50.00). Under this grant agreement, the Fruit and Vegetabel Inspection Unit's audit clients pay $23.00 per hour (25%) and the grant covers the remaining $69.00 per hour (75%).

In addition to performing the on-site certification audits, this grant helped the Fruit & Vegetable Inspection Unit provide several free workshops or informal seminars for growers. These seminars are typically organized by trade organizations for their members or by processing facilities for their suppliers. They provide an opertunity for growers to learn about the GAP/GHP requirements before they commit to the audit. FY2009 (grant period beginning Dec. 10, 2009) was the first time SCBGP funded GAP/GHP audits.

II. Project Approach

The Fruit & Vegetable Inspection Unit conducted 55 GAP/GHP audits with the assistance of this grant. Most of the businesses audited were growers but there were also some packing & distribution facilities. The growers were from all over the state and the products included:

apples, beets, brussel sprouts, cantaloupe, carrots, cauliflower, cucumbers, kale, kohlrabi, mushrooms, muskmelon, onions, pea pods, peppers, potatoes, spinach, squash, sweet corn, sweet potatoes, Swiss chard, tomatoes, turnips, watermelon, and zucchini.

This grant also provided support to The Fruit & Vegetable Inspection Unit by sharing in the unit's costs for which it does not bill customers. Over the grant period, Tim Leege appeared at sixteen workshops or seminars to talk about GAP/GHP standards and the certification process. These workshops are typically arranged by grower trade organizations or businesses that buy the growers' products. These workshops are an excellent opportunity for growers to learn what will be expected should they continue to seek GAP/GHP certification.

The grant also covered part of the cost of having an additional inspector certified to conduct GAP/GHP audits. Perry Engle traveled to Colorado twice during the grant period to receive training and obtain certification from USDA/AMS.

III. Goals and Outcomes Achieved

Before receiving this grant, the Fruit and Vegetable Inspection Service conducted an average of about 38 GAP/GHP audits annually and attended about four grower workshops. During the one year that this grant was in effect, The Unit performed 55 GAP/GHP audits and attended sixteen grower workshops. The increased grower particpation in the program is an achievement.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

In the initial grant request, the goal was to complete 20 more audits than baseline. We actually performed 17 additional audits and hope to add more in the following year.

IV. Beneficiaries

The purpose of this project was to make third-party Food Safety Audits (GAP/GHP) available to small and medium-size Wisconsin growers, many of whom would not otherwise have the resources to pay for the audits. Speciality crop buyers are increasingly requiring growers and packing facilities to obtain third-party audits. Growers who are unable to comply may loose market share and find themsleves at a competitive disadvantage.

V. Lessons Learned

The initial grant agreement was for $50,000. However, during the period, it was clear that there was not sufficient demand to spend the entire $50,000. Therefore, the parties mutually agreed to reduce the total grant amount to $25,000.

The initial grant proposal also included $1,000 for publication and distribution of a manual. However, Fruit & Vegetable Inspection Unit staff has been distrubuting materials prepared by USDA instead. There has been no need for the unit to prepare its own manual.

VI. Additional Information

None

VII. Detailed Financial Reports

The Fruit & Vegetable Inspection Unit billed a total of 287 hours for 55 GAP/GHP audits. The total cost (at $92.00 per hour) was $26,427. The availability of this grant made these audits much more affordable. The grant budget allowed for $17,600 in cost share audit expenses, but the actual grant cost (75% of this total audit cost) was $19,820.

Fruit & Vegetable Inspection Unit staff spent about 142 hours conducting seminars and workshops for growers on how to comply with GAP/GHP requirements and spent about 98 hours attending training and testing sessions sponsored by USDA/AMS to gain credentials as a GAP/GHP auditor. The the actual employee costs (salary & fringe) of these hours was about $5,585 and the total travel cost (milage, lodging, airfare, etc.) associated with these activities was $5,381. The grant budget allowed for $3,400 in employee expenses and $3,000 in travel expenses. In our final payment request, we requested the full $3,400 for employee expenses, but limited the travel reimbursement request to $1,780. Othewise, the total of the audit cost share, employee expenses, and travel expenses would have exceeded the total grant budget of $25,000.

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14) WI DATCP – Division of Agricultural Resource Management

Project Title: Survey for Corky Ringspot Disease of Potatoes in Wisconsin

Total Amount Received: $15,000

Date of Award: December 1, 2009

Project Contacts: Annette Phibbs

Report Date: January 7, 2011

I. Project Summary

Corky ringspot was first detected in Wisconsin in 2007. Corky ringspot disease, caused by tobacco rattle virus, renders tubers unsuitable for processing and causes considerable problems in storage. The disease is considered a regulated one by Mexico; adequate presence/absence data will support the declaration of limited distribution in the state, enhancing export.

This project continues work undertaken in the 2008 non-farm bill SCBG; the continuing survey effort has allowed sampling of additional potato rotation ground, and has enhanced the educational efforts begun last year, strengthening the message that growers need to use quality seed stock and proper sanitation to exclude the disease from their farms.

II. Project Approach

Field Sampling: For the FY09 survey DATCP Fruit and Vegetable Inspectors and staff plant pathologists sampled storage facilities from Dec 3, 2009 to Apr 7, 2010. Fields and grading lines were sampled from Aug 10 to Oct 12. From Oct 20 to Dec 6, collections were done from storage facilities and fresh markets. Inspectors were choosing tubers with external symptoms, if no symptoms were present, tubers were chosen at random. A total of 242 samples consisting of eight tubers for each sample were collected in this time frame. This exceeded the target of 150 samples for FY09. Below is the total number of samples collected by county. A total of 14 counties were sampled in 2009, the survey was extended to reach additional counties and grower groups to a combined total of 24 counties surveyed in 2009 and 2010. This includes Wisconsin's major potato growing areas.

Number of potato tuber samples tested in from each Wisconsin county

County	2009 & 2010	2009	2010
Adams	35	21	14
Buffalo	3	0	3
Columbia	1	0	1
Dane	21	6	15
Dunn	28	15	13
Forest	7	7	0
Iowa	7	3	4
Jackson	2	0	2
Jefferson	3	0	3
Juneau	15	15	0
Langlade	73	35	38
Marathon	3	2	1
Marinette	9	2	7
Milwaukee	3	0	3
Ozaukee	3	0	3
Pepin	6	3	3
Portage	117	28	89
Richland	5	0	5
Rock	1	0	1
Sauk	2	2	0
Vernon	5	0	5
Vilas	9	2	7
Waukesha	2	0	2
Waushara	14	9	5
unknown counties (markets)	18	0	18
Grand Total	392	150	242
Total counties surveyed	**24**	14	21

Laboratory processing: FY09 Samples were processed at Plant Industry Laboratory starting shortly after the arrival of the first samples from Dec 2009 to Dec 15, 2010. The processing followed closely on the collection of tubers which was dictated by the seasonality of potato production in the Mid-west, grower cooperation and work load of inspectors. At the lab tubers were cut open and screened for necrotic tissue, which was immediately cut out and processed for RNA extraction. Tissue sampling and analysis followed published peer reviewed protocols for nucleic acid assay.The test method utilized, RT-PCR or reverse transcription polymerase chain reaction is highly sensitive and very effective in detecting the presence of this virus. Reference: D.J. Robinson, Journal of Virological Methods. 1992, 40, 57-66." Detection of tobacco rattle virus by reverse transcription and polymerase chain reaction."

Report and map for publication:
All reports, publications and powerpoint presentations were published on the pest survey webpage in January and February of 2011 in time for grower meetings. All growers were send results for their individual fields and a copy of the fact sheet on "Corky ringspot of potatoes".

Fact sheets were also provided to the University of Wisconsin Seed Inspection Office for distribution to all growers. The information was also handed out at all meetings. The Badger Common Tater, the Wisconsin potato industry newsletter with a circulation of 4000 also printed articles.

Webpage for potato diseases: http://pestsurvey.wi.gov/plantdisease/potato.html

Webpage survey summary: 2009 & 2010 Corky Ringspot Disease Survey of Potatoes

http://pestsurvey.wi.gov/plantdisease/pdf/potato/2010CorkyRingspotOfPotatoes.pdf

Webpage fact sheet about Corky Ringspot Disease of Potatoes:

http://pestsurvey.wi.gov/plantdisease/pdf/potato/CorkyRingspotOfPotatoesFactsheet.pdf

Powerpoint presentions about Corky Ringspot on pest survey webpage:

http://pestsurvey.wi.gov/program/presentations.html

Presentations to grower meetings: The survey summary was given at the Wisconsin Seed Potato Improvement Association meeting in Polar, Wisconsin January 26, 2011. Approximately 50 growers were present at this annual meeting, this is the majority of all Wisconsin seed growers. The information was also presented at the Wisconsin Potato and Vegetable growers meeting in Stevens Point in February of 2011. Several hundred growers attend this meeting including most of the producers of ware potatoes and the seed growers. More presentations would be happily provided at growers' requests but the groups at the above mentioned meetings are the target audience and additional presentations to other groups were not requested.

III. Goals and Outcomes Achieved

Results of the Survey:

In 2009 and 2010, 69 potato growers participated in this state wide survey, expanding the surveyed area from 14 counties in 2009 to 24 counties in 2010.

Tubers came from a variety of types of farms such as: seed (20%), commercial processing (65%) and fresh market producers (15%). This included certified organic (18%) and conventional farms (82%). The FY09 survey extended the participating grower groups to fresh market and organic production.

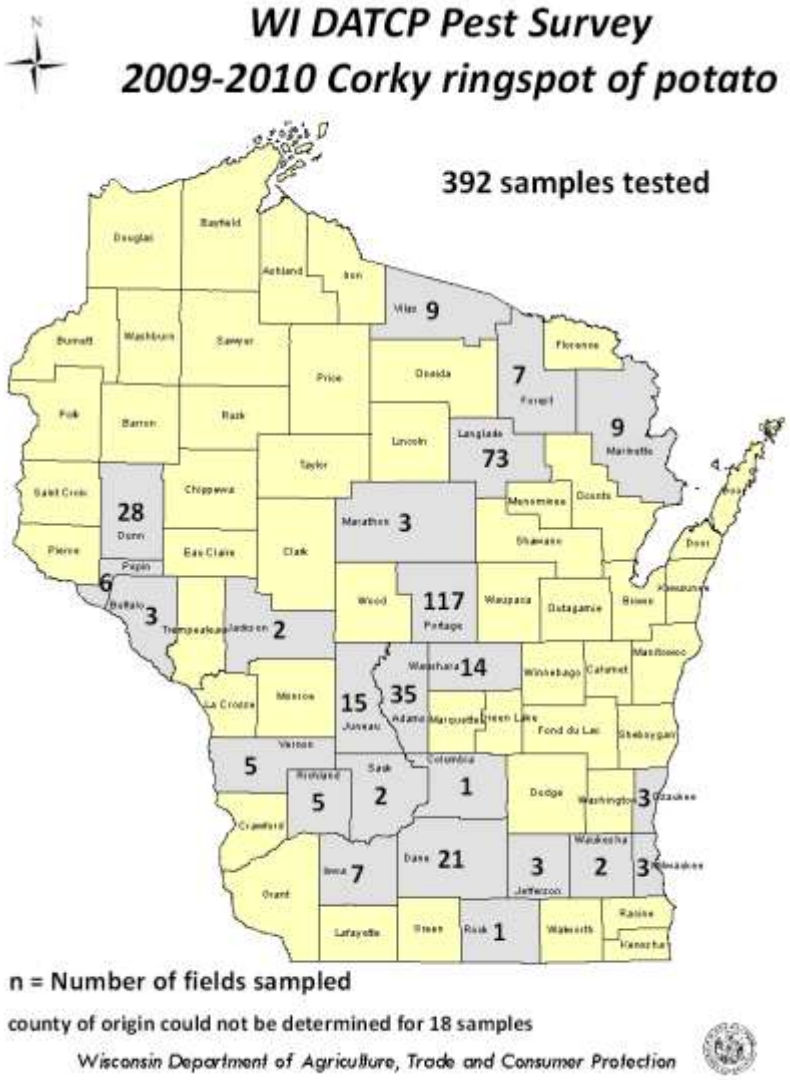
Number of Potato Samples Tested by Source

Seed	Processing	Fresh Market	Total Number
80	252	60	392

Conventional	Certified Organic	Total Number
320	72	392

Tobacco rattle virus was confirmed on five Wisconsin farms. Only 1.5% of a total of 392 samples tested positive for TRV. Three farms had no prior finds of this disease. These three new finds in Adams, Portage and Langlade Counties showed very low infection levels.

Corky ringspot disease symptoms and tuber blemishes had not been observed in these fields, indicating that this was an early detection of a low level infestation. Two positive samples were grown on farms in Buffalo and Dunn Counties that had previously experienced losses due to this virus. Several potatoes from these fields showed interior tuber blemishes.



B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

A target of 150 samples was planned; 229 samples were gathered and analyzed, surpassing the target goal. Results are available on the Pest Survey website and will be communicated to growers during winter educational meetings.

IV. Beneficiaries

Benefit to Individual Growers: Each participating grower received individual field test results and informational material about this disease. Grower awareness of Corky ringspot disease was

raised through participation in this survey and interaction with inspectors. Three out of the five potato growers whose tubers tested positive found out for the first time that this disease was present in their fields. The early identification of low level infestations provided them with the opportunity to examine and evaluate their management strategies. University of Wisconsin potato experts and Seed Certification Program staff were made aware of the situation and consulted with growers to assess options such as seed source, crop rotation choices and use of pesticides.

Benefit to the Industry:
This project is beneficial to Wisconsin potato growers because it determined that Corky ringspot disease of potatoes is not wide-spread in in this state. The data confirms that prevention is a valid management strategy, and use of pesticides and fumigants should be limited to few isolated locations that have known infestations. Management strategies such as choosing clean seed sources and maintaining good sanitation practices were emphasized as effective tools to growers.

The survey documents the absence of this pest from the majority of Wisconsin's potato fields enhancing the marketability of Wisconsin potatoes. Survey data is available to DATCP's Phytosanitary program to facilitate export certification and international trade.
The summary report including a map of the sampled major growing areas and disease information were made available to all growers and the general public.
This benefits the entire Wisconsin industry which in 2010 ranked 3rd in potato production with a value of $397million in the nation (USDA NASS "Potatoes 2010 Summary – September 2011, http://www.nass.usda.gov/Statistics_by_State/Wisconsin/Publications/Annual_Statistical_Bulletin/page3.pdf). The value of the Wisconsin seed production was estimated at of $257 million in 2010.

Benefits for Pest Detection: This project provided the Plant Industry Laboratory with the opportunity to run a large number of tests and further validate and improve test protocols, resulting in the ability to assist growers with a ready and rapid detection service in the future. The availability of large number of tuber samples for this project also allowed us to piggy-back a survey for powdery scab onto this project. That information is also available on our pest survey website http://pestsurvey.wi.gov/plantdisease/potato.html.

V. Lessons Learned

Organic growers were represented in the sampling, 19 samples associated with 10 certified or so-represented organic operations, ~9% of samples), but the project had hoped to more thoroughly represent organic growers in the survey, since that community has been underserved in the past and the Pest Survey program is looking to strengthen networking ties with that segment of the industry.

VI. Additional Information

A fact sheet about Corky ringspot disease has been published on our website at http://pestsurvey.wi.gov/plantdisease/potato.html and was mailed to all participating growers.

VII. Detailed Financial Reports

Funds were spent as follows:

Salary/Fringe:	$7274.38
Supplies:	$7264.62
Other:	$461
Total:	**$15,000**

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15) WI DATCP – Division of Agricultural Resource Management

Project Title: Pest Detection in WI Vegetable Crops

Total Amount Received: $25,000

Date of Award: December 1, 2009

Project Contacts: Adrian Barta

Report Date: January 7, 2011

I. Project Summary

The 2010 Pest Detection in WI Vegetable Crops survey effort focused on several potential pest threats to vegetable production in the state: viruses of snap beans known to occur in the state, but lacking adequate characterization; three insect pests not known to occur in Wisconsin (swede midge, Contarinia nasturtii and old world bollworm, Helicoverpa armigera, and whitefringed weevil, Naupactus leucoloma; and an emerging disease of vine crops and peppers caused by Phytophthora capsici.

Virus damage to snap beans has increased dramatically since the arrival of the soybean aphid (Aphis glycine), first detected in Wisconsin in 2000. Losses to processing crop growers have, in isolated incidents, reached 80% or higher (pers. comm.). Characterization of the particular viruses attacking snap beans has not been done on an extensive geographic basis; knowledge of the variety of viruses present in the snap bean growing areas would provide guidance on strategies to minimize losses, strategies that might include variety selection, timing of planting, spatial separation of fields, rotations and chemical control measures.

The three insects included in the survey are not known to occur in Wisconsin, but are known for causing considerable losses where they are established. Early detection of these pests will provide for delimitation and assessment of the initial infestations, preserving as many quarantine, control or eradication options as possible. In addition, detection of infestations while small will allow the maximum time for research, adoption of appropriate control measures, and grower education.

Phytophthora capsici has caused severe losses of susceptible host crops, specifically pumpkins and peppers, on a very limited basis in Wisconsin, though it has been reported as widespread from Illinois for several years. Detection and delimitation of the current distribution will provide growers with knowledge to take appropriate control measures.

This project expanded upon a 2008 non-farm bill SCBG survey of viruses in snap beans, continuing that survey effort while addressing a number of other significant pest threats to vegetable production in Wisconsin. The relationships built in the 2008 survey were used to engage growers of other vegetable crops.

II. Project Approach

Snap beans: Snap bean fields with a target growth stage of 48 days post-planting were surveyed for soybean aphid presence and leaf samples were collected for laboratory analysis of virus presence. Samples were tested for alfalfa mosaic virus (AMV), bean pod mottle virus (BPMV), cucumber mosaic virus (CMV), the potyvirus group of plant viruses (POTY), southern bean mottle virus (SBMV) and tobacco ringspot virus (TRSV). Because 2009 laboratory results indicated less virus presence than grower and surveyor assessment of field symptoms suggested, SBMV was an addition to the lineup from the 2009 analysis. 78 fields were sampled for virus, all processing crop fields. Of the fields and viruses tested, only four fields were confirmed to have virus. CMV-positive fields were detected in Portage and Waushara counties, and one field in Waushara county was infected with both a potyvirus and CMV. Likely due to adequate insect control measures on the part of growers, no soybean aphids were detected in fields. Participation by the processor crop growers was a key component of the survey.

Insect trapping: traps for swede midge (a pest of cabbage present in New York, but not known to occur in Wisconsin) were set at four locations (four counties) and serviced on a biweekly basis. Traps for old world bollworm (a polyphagous pest not known to be established in the United States) were set at three sites (three counties). Traps for whitefringed weevil, a pest of potatoes (among other hosts) known to be established in the southern United States but not found in Wisconsin to date were set in three counties. No target insects were trapped. Trapping was done with the cooperation of the various vegetable growers.

Phytophthora capsici: Fourteen pumpkin fields and one associated pepper field--all fresh-market-- in nine counties were surveyed for symptoms of Phytophthora capsici, and samples collected where appropriate. Phytophthora was detected in one pumpkin field and a pepper field belonging to the same farm in Walworth county; in both fields, the loss was nearly total, comprising 10 acres of lost pumkins and 2,000 lost pepper plants. Information on the occurrence was shared with University of Wisconsin specialists, to help with outreach.

Maps of these surveys were published on the website of the Wisconsin Pest Survey (http://pestsurvey.wi.gov/plantdisease/more_vegetables.html) and included in the Wisconsin Pest Bulletin (http://datcpservices.wisconsin.gov/pb/index.jsp). Snap bean virus results were also presented to the 2010 Wisconsin Crop Management Conference and included in the proceedings. Results were also provided to the HALTVICK group, made up of regional field managers of the various canning companies and vegetable seed producers. Information on results was provided to organic growers in Wisconsin via an exhibit at the MOSES Organic Farming Conference, March 2010. A map of results accompanies this report.

III. Goals and Outcomes Achieved

With the exception of snap bean field sampling, all field sampling, trapping and laboratory analysis was completed in a timely fashion.

B. All surveys met the target goals for sampling except the snap bean survey, which sampled 78 fields, falling short of the target of 100 fields. Reasons for the shortfall include an unusually compressed growing season, due to warm and wet weather that led to early harvest, and lower-than anticipated grower response to requests for field locations. Overtures to fresh-market snap

bean growers received less response than expected, and information about planting dates was more difficult to derive from those growers.

Hoped-for publication in the Badger Common 'Tater did not materialize, but DATCP Pest Survey personnel staffed an exhibit at the Wisconsin Potato and Vegetable Growers meeting in Stevens Point in January.

IV. Beneficiaries

Groups which may benefit from information produced by this project include snap bean growers and processors, cabbage growers, and vine crop growers. Both processing and fresh-market growers are affected by the pests targeted in this project; information on the occurrence or absence of these pests will help growers target both scouting and control efforts.

Information from the surveys was published in the Wisconsin Pest Bulletin (http://pestbulletin.wi.gov/, 1200+ regular readers) , posted to the Wisconsin Pest Survey web site, and selected data was delivered in presentations to the Wisconsin Crop Management Conference, with an estimated 350 audience members and significantly more growers and scouts with access to the Proceedings.

V. Lessons Learned

Weather has a great influence on the rate of growth of plants, which we knew--the ability to redirect survey resources and flexibility in broad sampling plans is critical.

VI. Additional Information

Final results and presentations by DATCP staff will be posted at the DATCP Pest Survey website, http://pestsurvey.wi.gov/

VII. Detailed Financial Reports

Salary/Fringe:	$13,450.27
Supplies:	$8812
Travel:	$2737.73
Total:	**$25,000**

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16) WI DATCP – Division of Food Safety

Project Title: Buy Local, Buy Safely

Total Amount Received: $20,000

Date of Award: December 1, 2009

Project Contacts: Sandra Cleveland

Report Date: June 14, 2012

I. Project Summary

Many people are purchasing more locally-grown produce in response to "Buy Local" initiatives that stress that locally-grown foods are fresher and that buying locally-grown food is a good way to support family farms and the local economy. However, current food safety regulations provide little guidance for evaluating the food safety practices of local produce-growing operations. Food safety regulatory agencies generally lack specific jurisdiction over fruit and vegetable growing operations. In addition, cost considerations prevent many small producers from pursuing formal Good Agriculture Practices and Good Handling Practices certification.

This project was designed to increase awareness of produce-related food safety and to provide a science-based tool that producers, buyers, and consumers could use to evaluate food safety practices for growing and handling locally-grown fruits and vegetables. Specifically, this project resulted in a website and print guidance for evaluating food safety practices used by produce farmers who sell fruits and vegatables locally.

II. Project Approach

The Division of Food Safety (DATCP-DFS) achieved the primary activities and goals of the project, including the following: Forming a Buy Local, Buy Safely workgroup comprised of representatives from the grocery, growers, and city/county regulatory sectors; reviewing literature related to food safety practices on produce farms; developing a draft set of guidelines; soliciting input from the workgroup on the draft guidelines; working with the Department's information technology staff to develop an interactive, online version of the guidelines; publishing and distributing over 2,000 printed copies of the guidelines; and evaluating the usefulness of the project.

Project partners made significant contributions to the project. The Buy Local, Buy Safely workgroup, for instance, reviewed the preliminary draft and suggested the Division revise the target audience for the booklet. Organizers of the Wisconsin Fresh Fruit and Vegetable Growers Conference provided a venue for booklet distribution, and farmers' market managers throughout the state provided valuable assistance distributing and evaluating the final booklet. We also

worked with the DATCP Bureau of Information and Technology Services staff to develop an interactive version of the food safety checklist and with DATCP-DAD staff to post the booklet online. Staff in DATCP-DFS continue to identify new audiences for the booklet, such as Community Supported Agriculture organizations (CSA's), to continue efforts to improve food safety practices in the production of locally-grown fruits and vegetables.

III. Goals and Outcomes Achieved

The project met its primary goal of developing useful and effective guidelines for evaluating the food safety practices used by producers of locally-grown food by using grant funding to develop, print and distribute the booklet, "Locally Grown: Making it Safe". We established a workgroup consisting of the following members:

Jim Blackmore, Public Health Madison - Dane County
Richard DeWilde, Harmony Valley Farm
Dick and Vivian Green, Pleasant Springs Orchard
Dr. Jay Ellingson, Kwik Trip, Inc.
Michelle Kussow, Wisconsin Grocers Association, Inc.
Eric Johnson, Jordandal Farms and G.L. Ag Ventures, LLC
Dr. Barbara Ingham, University of Wisconsin-Extension

We completed work on the guidelines and printed 2,000 copies of the final booklet in December 2011. We distributed over 2,000 of the booklets by March 31, 2012. We collected evaluation data until March 31, 2012. Although we completed work on the project on March 31, 2012, we continue to distribute copies of the booklet using program resources and plan to use the booklet in outreach activities long beyond the end of the grant project.

This was a small-scale project, which limited the ability to measure long-term outcomes. However, in the spring of 2011, we conducted a formative evaluation by distributing a draft of the guidelines to the workgroup and soliciting their opinion about the usefulness of the guidelines. Originally, along with producers of locally-grown produce, the target audience for the guidelines also included restaurants and retail food establishments, with the intention that these businesses could use the guidelines to assess the safety of the produce they purchase. However, as part of the formative evaluation, restaurant and retail food establishment owners indicated that the guidelines would be more useful for producers rather than businesses that buy locally-grown produce. We revised the guidelines to reflect this perspective.

We completed work on the guidelines and published 2,000 copies of the final booklet in December 2011. To conduct a summative, outcome evaluation of the booklet, we surveyed the farmer's market managers to determine the extent to which they found the booklet useful. All farmer's market managers who responded to the final evaluation indicated that the booklet will be somewhat or very useful for evaluationg safety practices on farms that sell produce locally. We have attached a copy of the evaluation results.

We distributed the majority of the booklets and collected evaluation data until March 31, 2012. After we completed work on the project, we publishing an additional 1,000 copies of the booklet using non-grant, program funding and we continued to distribute and use the booklet in outreach

activities. For example, we recently distributed approximately 250 booklets of these booklets to Wisconsin's Community Supported Agriculture (CSA) owners.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

The primary goal of the project was to develop and distribute science-based guidelines for evaluating food safety practices used to produce locally-grown fruits and vegetables. We printed 2,000 copies of the final document in December 2011 and completed distribution and a final evaluation of the booklet by March 31, 2012.

IV. Beneficiaries

This project provides valuable food safety information to fruit and vegetable producers who sell their produce locally. We distributed the initial 2,000 copies of the booklet to producers primarily through two methods. First, Division representatives attended the Wisconsin Fresh Fruit and Vegetable Grower's Conference in January 2012 where approximately 150 copies were distributed directly to producers attending that convention. Second, in February, 2012, a copy of the booklet was sent to approximately 165 farmer's market managers in the state of Wisconsin. Farmer's market managers were then provided the opportunity to request additional copies of the booklet to distribute to their vendors. All remaining copies of the booklet were requested by these managers for distribution. The Division has since published an additional 1,000 copies of the booklet using non-grant, program funding. The Division plans to send the booklet to Community Supported Agriculture operations (CSA's) in Wisconsin, as well as to other interested groups upon request. Ultimately, this project most benefited Wisconsin consumers of locally-grown food who purchase food from farmers who use the information prepared through this project to produce safer food.

V. Lessons Learned

This project successfully met its goals and outcomes by producing a useful, science-based booklet that small producers may use to assess their food safety practices for growing and handling fruits and vegetables to be sold in local markets. Due to financial and time constraints, the Division modified the approach it used to develop the booklet, focusing its efforts less on workgroup meetings as originally planned and more on the actual development, printing and distribution of the booklet. The Division did establish a workgroup as part of the project, however, and solicited their opinion about the draft version of the guidelines. The Division modified the target audience based on these opinions to focus more clearly on the needs of producers rather than buyers. The Division also revised its original plan for evaluating the booklet and used both a paper survey and the option of completing an online survey to conduct the final outcome evaluation of the booklet. Finally, although not considered in the original plan for the project, the Division found it useful to involve farmer's market managers in the distribution and evaluation of the booklet. Modifications to the process used to develop and evaluate the booklet made the project more effective and allowed the Division to complete the project with limited funding.

Through all these developments we learned that it is important to carefully evaluate whether the group receiving the project deliverable items actually has the time and interest required for

successfully using them. Ideally this determination should be made before the project grant application is written, but time pressures do not always permit this evaluation and those who say they are willing to participate when it's only an idea do not necessarily come through when it's time to put the idea into action.

In this project, we learned during formative evaluation that restaurant and retail food establishment operators did not feel they had the time or interest to carefully evaluate the food safety programs of their produce suppliers. It was apparent that most business operators had not experienced a cost associated with purchasing from growers who did not implement a robust food safety plan. While this finding was disappointing, it helped us learn that food safety information must be presented by the grower to their customer in a concise, quickly understandable manner. We determined that the information we provided to the grower should allow the grower to succinctly describe their food safety efforts. Therefore, we added a checklist to the guidelines. Using the checklist would result in a numerical "score" that could describe a produce grower's food safety program to the restaurant or retail food establishment operator.

VI. Additional Information

We have attached a copy of the booklet as well as a copy of the results of the final evaluation of the booklet. The guidelines are available online at the following web addresses:
http://datcp.wi.gov/uploads/Food/pdf/OnFarmFoodSafetyBook.pdf

http://datcp.wi.gov/Business/Buy_Local_Buy_Wisconsin/Safety_Assessment/

VII. Detailed Financial Reports

$17,100.20	was spent on salary and fringe for staff developing the booklet
$2899.80	was spent on printing and distributing the booklet
$20,000	**Total**

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17) WI DATCP – Division of Agricultural Development

Project Title: A Consumer's Guide to Organic Foods & Directory of Organic Specialty Crop Producers

Total Amount Received: $9,900

Date of Award: December 1, 2009

Project Contacts: Laura Paine

Report Date: October 31, 2012

I. Project Summary

In 2005, the Wisconsin Organic Task Force identified consumer education as the top priority for growing the market for organic products in the state. In the words of the Task Force: "Consumers do not adequately understand what the term 'organic' means or why they should consider purchasing organic products." (WI Organic Task Force Report 2005).

While consumer awareness has probably increased since 2005, so have the number and diversity of eco-labels in the marketplace. The purpose of this project was to produce a series of consumer education and marketing pieces that address the difference between organic certification and other eco-labels as well as provide research-based information on the benefits of organically raised products, with the ultimate goal of supporting organic farmers' marketing efforts and increasing purchasing of organic food. Also in support of that goal, we planned to publish a directory of organic specialty crop growers to allow retail and wholesale buyers to find them more readily. These publications are intended to be available in hard copy and on-line for farmers to share with their customers, to use on sales calls to wholesale buyers, or for retailers to use as point-of-purchase materials.

We assembled a team of partners from agencies and organizations across the organic industry, including members of the WI Organic Advisory Council and representatives of University of Wisconsin Extension, Midwest Organic and Sustainable Education Service (MOSES), Midwest Organic Services Association (MOSA), Outpost Natural Foods (a 14,000 member food cooperative in Milwaukee, WI), and the Madison Area Community Supported Agriculture Coalition (MACSAC), coordinated by Laura Paine. The team started by surveying farmers and consumers to determine what topics are of most concern to cover in the publications as well as what formats were most appropriate. The team then worked to develop the materials: a 20-page booklet, a tri-fold brochure, a bookmark, a rack card, and a magnet, each covering a different part of the organic story. We tested the content and readability of the materials through a focus group of DATCP staff and a review by UW Extension specialists. Finally, we distributed the materials through mailings and events and solicited evaluation surveys from consumers and farmers. The materials are available on the DATCP website in a downloadable format for

consumers as well as high resolution PDFs for farmers to download and print copies for their own marketing purposes.

II. Project Approach

The project was conducted by a team comprised of members of the WI Organic Advisory Council and representatives of University of Wisconsin Extension, Midwest Organic and Sustainable Education Service (MOSES), Midwest Organic Services Association (MOSA), Outpost Natural Foods (a 14,000 member food cooperative in Milwaukee) and the Madison Area Community Supported Agriculture Coalition (MACSAC), coordinated by Laura Paine, DATCP's Organic Agriculture Specialist. To complete our work, the team met periodically over the three years of the project in person and via conference calls.

PRELIMINARY RESEARCH

Our preliminary surveys were conducted with farmers and consumers to determine the specific questions and topics most important to cover in the publications. We worked with MACSAC and MOSA to survey 42 organic farmers regarding what questions about organic farming they get most often from their customers. We also surveyed about 177 consumers through the Outpost Natural Foods Cooperative in Milwaukee to determine how much consumers know about organic food and what misconceptions might exist.

The majority of the consumers responding to the on-line survey were women (83.6%) and 92% of the respondents identified themselves as the primary food buyer in their household. Seventy-nine percent were regular organic food buyers and were quite knowledgable about organic farming practices and what the organic label means. More than 85% of respondents knew that organic farmers are not allowed to use synthetic pesticides and fertilizers and more than 70% knew that they do not use antibiotics or GMOs.

Because the consumer survey didn't pinpoint specific issues where confusion exists, we focused the content primarily on the responses from the organic farmers we surveyed. We asked them what questions they get from their customers at their farmers market stands and in other interactions with customers. We determined that the following topics were the most important issues to cover in our materials: 1) The difference between organic and natural products, 2) The issues surrounding GMOs and organic food, 3) The relationship between local food and organic food, 4) The nutritional quality of organic food, 5) The sustainability of organic farming, and 6) Where to find organic food and more information on organic food.

DEVELOPMENT OF MATERIALS

We made plans to develop a comprehensive document that covered these topics, then condense the material into separate topics for the shorter publications. Members of the team took responsibility for writing segments on specific topics for the comprehensive document, which ended up being a 20-page booklet. Laura then edited the document to improve organization and reduce differences in writing styles. We contracted with an independent writer/editor to developed text for condensed versions. These included a tri-fold brochure that summarizes the entire contents of the booklet, a bookmark that focuses on basics of what organic farmers do and don't do and identifies websites that tell where consumers can find organic food, a rack card that summarizes the different levels of organic labeling and provides suggested questions that

consumers can ask farmers about their practices, and a magnet that lists websites providing sources of organic food.

We conducted reviews of the materials using an informal focus group comprised of DATCP staff, as well as soliciting external reviews from UW Extension Specialists. The materials were modified in response to their suggestions.

OUTREACH AND EVALUATION
When the materials were completed, we printed copies of all of them as well as put them on line on the DATCP website:
http://datcp.wi.gov/Farms/Organic_Farming/Organic_Consumer_Guide/index.aspx. The materials are posted in a low resolution format for consumers to download and read as well as a high resolution format for printing. Our intent is that farmers can download the publications and have copies printed for distribution to their customers.

We have conducted outreach by having displays at a variety of venues in 2012. The Organic Farming Conference on February 23-25, 2012 in LaCrosse, WI, was the first. This is the largest organic farming conference in North America, attended by over 3000 farmers, agency staff and others. We also had displays at the Fair Share Community Supported Agriculture open house in Madison (3/18/12), at the Kickapoo Country Fair, an Organic Valley sponsored consumer event in LaFarge, WI (July 28, 2012), and at the Milwaukee Eat Local Resource Fair (August 25, 2012). In addition, we mailed packets of the Consumer's Guide materials to 175 farmers market coordinators across the state of Wisconsin. In total, we distributed approximately 1000 booklets, 1000 brochures, 1000 rack cards, 1500 bookmarks, and 500 magnets.

We have also updated our Organic Farmer and Business Directory, have printed 300 hard copies, and are in the process of updating the directory on-line:
http://datcp.wi.gov/Farms/Organic_Farming/Directory/index.aspx

We evaluated the effectiveness of the project using an online survey of consumers and another of farmers. Evaluation results will be shared under "Goals and Outcomes" below.

Primary target audiences for the Consumer’s Guide publication were farmers market vendors and coordinators, Community Supported Agriculture farmers, and Food Coop customers. While all of these could potentially include vendors of livestock products, 80% of our outreach and distribution of the finished publication was focused on organic vegetable and fruit growers. Only 20% of participants/recipients included any non-specialty crops in their operations. Any funds used for development of materials on meat and dairy or distribution to livestock and dairy producers were done using matching funds (approximately 38% of our budget was non-federal match).

III. Goals and Outcomes Achieved

The goals of this project were to produce new resources to allow consumers to find locally grown organic produce farms and to help them learn what organic certification means and how certified organic produce differs from conventional. Short term impacts we projected include 1) increased consumer awareness of and knowledge about organic practices and what organic

certification means and 2) a better competitive position for organic growers in the local foods market.

Impact 1: Increased consumer awareness of and knowledge about organic practices what organic certification means.

1) We posted the Consumers Guide materials on the DATCP website on April 18, 2012 and sent out a press release announcing the materials that week. We recorded the following numbers of 'hits' to that page over the following months:
April – 547
May – 363
June – 96
July – 571
Aug – 76
Sept – 52
Oct – 35

Since the initial printing in April, 2012, we have distributed approximately 1000 booklets, 1000 brochures, 1000 rack cards, 1500 bookmarks, and 500 magnets via a mailing to 175 farmers market coordinators as well as at the following events: the Organic Farming Conference on February 23-25, 2012 in LaCrosse, WI, Kickapoo Country Fair, an Organic Valley sponsored consumer event in LaFarge, WI (July 28, 2012), the Fair Share Community Supported Agriculture open house in Madison (3/18/12), and at the Milwaukee Eat Local Resource Fair (August 25, 2012).

In addition, 1000 additional copies of the 20-page booklet were printed and distributed by Standard Process, Inc., a Palmyra, WI company that uses organically grown vegetables and other plants to produce dietary supplements. The materials were distributed to chiropractors and other doctors who purchase their products for their patients.

2) We tested the materials with a focus group of 15 consumers.

Focus group results:
We asked focus group members to rate their knowledge of three specific topics covered by the materials before and after reading them.

On knowledge of food safety issues surrounding organic food, 50% of respondents reported a very good understanding after reading the publication, compared to 31% before.

On knowledge of nutritional quality of organic food, 57% reported very good understanding after reading the materials, compared to 50% before and the percentage who felt their knowledge was 'less than average' declined from 7% to zero.

On knowledge of the sustainability of organic farming, 63.7% of respondents reported having a very good understanding after reading the materials, compared to 48.3% before reading the materials.

Across the three issues, the percentage of respondents reporting a very good understanding increased from 48.3% to 63.7% after reading the materials.

3) We conducted an on-line survey targeting Outpost Natural Foods cooperative members and Farmers Market coordinators.

Consumer survey results:
A total of 98 consumers responded to our online survey on the Consumer's Guide to Organic Food. The majority of respondents read the 20 page booklet (84.4%), with fewer reviewing the brochure (70%), and small numbers reviewing the other items (17-26%).

In terms of overall awareness and understanding of organic agriculture and food, 39% of respondents reported moderate to very low knowledge prior to reading the materials versus only 10% after reading the materials. Respondents reporting that they felt they had extensive knowledge increased from 17 to 34%.

Eighty four percent of respondents reported good or high understanding of the issue of GMOs and organic food after reading the booklet.

Eighty five percent of respondents reported good or high understanding of the relationship between local and organic food after reading the booklet.

Eighty three percent of respondents reported good or high understanding of nutritional quality of organic food after reading the booklet.

Eighty three percent of respondents reported good or high understanding of nutritional quality of organic food after reading the booklet.

Eighty percent of respondents reported good or high understanding of the sustainability of organic farming after reading the booklet.

Eighty two percent of respondents reported good or high knowledge of where to find information on organic food and farming after reading the booklet.

Impact 2: A better competitive position for organic growers in the local foods market.

This goal was harder to measure. We provided ten growers a packet of literature to distribute during the 2012 farmers market season, with the goal of surveying them at the end of the season to assess the value of the materials. Of those ten farmers, we received seven surveys back. While none of them was able to assess whether having the materials increased their sales, two stated that the materials were very helpful in differentiating their organic products from other vendors', and two said that they were somewhat helpful.

We asked the farmers how well the materials answered the questions listed below on a scale of 1 = not at all to 5 = exceptionally well. Below is how they rated the materials on specific topics:

1. Why do organic foods sometimes cost more? Six of the seven respondents gave it a 4, one a 3.
2. What does a farmer have to do to get certified as organic? One 5, six 4s.

3. How do organic foods differ from natural foods? Three 5s, four 4s.
4. What is the relationship between local and organic foods? One 5, five 4s, one 3.
5. How sustainable is organic farming? Six 4s, one 3.
6. How do organic foods compare nutritionally with conventional foods? One 5, six 4s
7. Where can I find more information on organic foods? Three 5s, three 4s, one 3.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Impact 1: To assess increased consumer awareness of and knowledge about organic practices what organic certification means, we planned to conduct focus groups or do targeted surveys using a pre-post or post-then-pre evaluation format. We also planned to tally the number of publications distributed.

1. Focus groups and surveys.

We conducted a consumer survey of farmers market coordinators and Outpost Natural Foods members, receiving 98 responses. Forty seven of the 98 respondents recorded an increase in their knowledge of organic food and farming after reading the materials. This does not reach the target, but considering that 59% of the respondents listed their pre-survey level of knowledge as high or extensive, I think we provided good depth of information even for these well-educated consumers.

We conducted a focus group of about 15 DATCP staff for the other consumer survey. Focus group participants an average increase in knowledge of 19 percentage points.

2. Tally of the number of publications distributed and the number of hits to the website where the documents are posted.

We didn't set benchmarks for this goal, but we are satisfied with our success in this area. We totaled 1740 'hits' on our website. We distributed over 5000 booklets, rack cards, bookmarks, brochures, and magnets through a variety of events and got the materials into the hands of a majority of farmers market coordinators around the state.

Impact 2: A better competitive position for organic growers in the local foods market.

Our goal was for at least 50% of participating farmers to report an improved competitive position as a result of participating in the project. We worked with 10 organic farmers to test the materials during the 2012 farmers market season. Of the seven farmers we received surveys back from, two felt that the materials were very helpful and three felt they were somewhat helpful in differentiating their product from other vendors, but none of the farmers could clearly show that the materials provided an improved competitive position this first season. In retrospect, I believe this goal is really and intermediate or long term goal, which may be achievable in future years.

IV. Beneficiaries

The groups benefiting from this project include consumers and organic farmers. The publication and other materials will be helpful to the more than 1200 organic farmers, especially the 254 organic vegetable farmers, in Wisconsin.

It will also be helpful to 175 Farmers Market coordinators in the state, to help them address labeling issues that occur at farmers markets with regard to the term 'organic'. When we sent the materials to this audience, I got several calls from farmers market coordinators thanking me for the clarification of what farmers need to do to legally use the term when selling at the farmers market.

The third audience is consumers. National surveys indicate that 60 to 70% of consumers purchase organic foods. Of those, about three-quarters purchase organic foods regularly and one-quarter occasionally. This means that the audience for this information may be up to 1.6 million of Wisconsin's nearly 2.3 million households. Consumer surveys show that there remains a high level of confusion, especially about the difference between foods labeled certified organic versus 'natural'. A Mintel survey (Consumer Attitudes Toward Natural and Organic Food and Beverage - US - March 2010) found that more than one in four (28%) agreed that "'organic' and 'natural' mean the same thing to me when I see them on product packaging." This publication has the potential to provide clarification to consumers not only in Wisconsin, but nationwide.

V. Lessons Learned

The project resulted in a high-quality, comprehensive 20-page publication as well as several point of purchase pieces that should be valuable to organic farmers who direct market their products. These materials will remain available for farmers and consumers to download from the WI DATCP website.

Several of our farmer reviewers did not find the materials as valuable as we thought they would be for farmers market use. They explained that their tables were too full to add a publication and they tended to be too busy to distribute them. A better location for such materials might be at the general information booths that many farmers markets have, at information stations in food coops and grocery stores, and perhaps in CSA boxes.

We found that our consumer evaluation plan, which involved working with members of Outpost Natural Foods Cooperative, targeted consumers that are already quite knowledgeable about organic foods. We probably would have been able to more effectively test the materials if we'd worked with a more general consumer population.

VI. Additional Information

Copies of the publications will be mailed

VII. Detailed Financial Reports

Original budget:

SUPPLIES:	$200 for Copying, office supplies, etc.
CONTRACTUAL:	2500 for writing editing and laying out the consumers guide $500 for editing, proofreading, laying out the producer listing
OTHER:	$4000 for printing the consumers guide $1500 for printing the brochure and point of purchase materials

	$1000 for printing the producer directory
	$200 for mailings and postage

TOTAL $9900

<u>Actual spending</u>

SUPPLIES:	$67 for Purchase of produce for publication photo shoot
CONTRACTUAL:	$2100 for contract editing and layout of the materials
	$322.98 for creation of posters and displays
OTHER:	$201.75 for mailings and copying
	$150 for promotion of materials atFair Share CSA Open House
	$4122.32 for printing 1500 copies of the Consumers Guide booklet
	$892.05 for printing 1000 copies of the brochure
	$363.96 for printing of the bookmark
	$150.33 for printing 500 of the magnet
	$316.93 for printing 1000 of the rack card
	$771.53 for printing 300 copies of the Organic farm and business directory

TOTAL = $9458.85

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18) WI DATCP – Division of Agricultural Development

Project Title: Sustainable Farming Practices for Underserved Fresh Market Growers

Total Amount Received: $40,000

Date of Award: December 1, 2009

Project Contacts: Kathy Schmitt

Report Date: December 13, 2012

I. Project Summary

Underserved farmers represent an untapped resource for increasing the supply of local fresh market crops. Yet, these are farmers who indicate a strong desire to improve their farming methods and to farm more sustainably. Hmong, Hispanic/Latino, and other underserved farmers (i.e. African American, Native American, and women) have not, historically, participated in mainstream agricultural education in order to improve their farming practices and enhance their sustainability. This project built on momentum that began with a USDA Risk Management Agency Outreach grant in 2008. The Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) had been working on outreach and assistance through this grant to reach underserved farmers. The majority of them have been fresh market growers. From workshop evaluations, surveys, and individual conversations with these farmers, a great deal was learned about the educational needs of these farmers. They want:

- to improve their farming practices
- programming that is culturally relevant and in their native language
- to learn proper methods of using pesticides and herbicides
- to integrate more organic practices into their farming methods
- to increase their production and improve their sales
- hands-on and farmer-to-farmer learning

In addition, these groups need:

- More information on safe food handling
- Easy to use record keeping methods
- Information on public and private resources to help them

As interest in local foods grows, the need for beginning farmers grows, and consumers are more concerned about how their food is grown and handled, helping underserved farmers improve their practices and profitability becomes more important. This project was developed to begin the process of helping those fresh market producers develop their skills in these areas.

II. Project Approach

The project utilized two part-time Hmong speaking outreach specialists to organize and deliver workshops. These staf were located the East Central and South East areas of the state. A program manager led the team in developing targets and evaluation. Staff worked collaboratively with local Hmong community organizations as well as tapping into UW Cooperative Extension, UW Stevens Point, and Midwest Organic and Sustainable Education Servic (MOSES) for their subject expertise to speak at workshops. We worked collaboratively with the Farley Center, located in Verona, WI, which works with beginning and immigrant fresh market farmers. The Farley Center helped promote our workshops with their networks and provided Spanish translation for their consituents when needed.

Workshops were mostly held during the winter months, when the fresh market growers we targetd had more time to participate in activities. Topics included financial record keeping, marketing at farmers markets, organic production and certification, ginseng pest management,soil health, and hoop house construction. We experimented with offering a full-day conference for Hmong vegetable growers, including speakers on pest management for vegetable crops, safe food handling on the farm, and a panel of resource providers (UW Extension, Farm Service Agency, Natural Resource Conservation Service).

Participant sign-in sheets and evaluations were collected at workshops. Evaluations measured change in knowledge about the topic and gathered information about additional needs expressed by the growers as well as basic demographic information. Growers had a wide range of experience as vegetable producers, from beginning farmers with less than one year experience to seasoned growers of more than 20 years. Both men and women attended, with the vast majority being Hmong, followed by Hispanic and then Caucasion. Evaulation results revealed that participants felt they significantly increased their knowledge in all subject areas, frequently more than doubling their knowledge on the topic. Participants were eager to learn more in a variety of topics, most predominantly in organic production methods.

Our focus is very targeted to specialty crop growers and all the growers who have participated in any activities have been fresh market vegetable/fruit growers or are considering entry to producing and direct marketing their vegetables.

Outreach methods used to reach growers included direct mailing of flyers to Hmong growers that sell at farmers markets, press releases, Hmong radio announcements, and personal telephone calls. The workshops were frequently held at a local Hmong community center, which was felt to be a more comfortable setting for this target group. All workshops were presented in Hmong or translated into the Hmong language. Field notebooks were distributed to workshop participants and they were encouraged to use them to keep notes about their crops, production, pests, etc.

Additionally, the project worked with Astrid Newenhouse, a UW-Madison horticulture expert, with the UW Environmental Resources Center updated 4 fresh market vegetable growers' guides using the federal plain language guidelines. These guides provide detailed growing and harvesting information for small to medium scale vegetable producers. Guides covered tomato, salad greens, vine, and onion crops. The guides are available for download from web or for purchase from the UW-Extension Learning Store at cost. We also printed a number of them and made them available at workshops for no cost.

Conclusions and Recommendations:
Building trust with Hmong and Hispanic populations takes time and patience. It is important to have native speakers as direct contact with the community. We found it necessary to break items into small steps with as many visual and hands on opportunities to learn as possible.

As with other white producers, this group is comprised of growers who are interested in learning new methods and taking their operation to the next level as well as those who are more interested in lifestyle farming.

Record keeping is not a cultural norm and adapting record keeping tools will be a slow process. We have found the Hmong growers, in general, to be eager to learn more American ways of farming and they want to be able to provide their customers with an excellent product. They are especially interested in learning organic methods of production and pest management.

Field demonstrations work best as a teaching method, but it is difficult for them to make time during the growing season to participate in field-based workshops. Expect small numbers in workshops and meetings. These producers have told us that they prefer workshops that target Hmong people as they feel more comfortable asking questions in this situation than when with English speaking producers. There is a lot of opportunity to work with this population to develop their fresh market produce enterprises. Even though a number of them may have been farming for 10 years or more, they are more like beginning farmers in many respects, in terms of how we farm in the United States, even on a small scale.

Our outreach focus is very targeted to specialty crop growers. All the growers who have participated in these program activities have been fresh market vegetable/fruit growers.

III. Goals and Outcomes Achieved

A total of 13 workshops were held in a variety of geographic locations around the state, including Oshkosh, Wausau, Green Bay, La Crosse, Appleton, Milwaukee, Sheboygan, Manitowoc, Madison, and Eau Claire reaching 135 ethnic minority fresh market (specialty crop) growers and 5 white women fresh market growers. Topics included financial record keeping, marketing at farmers markets, organic production and certification, ginseng pest management, marketing to groceries, soil health, and hoop house construction.

Evaluation Results
Workshop participants completed evaluations after workshop presentations. They were asked to rate items on a scale of 1 to 5 (1= No knowledge; 2= Very little knowledge; 3 = I know enough to start using this knowledge; 4 = Good working knowledge; 5 = I could teach others about this subject). Evaluation summaries are presented below with average scores reflected.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.
See above

IV. Beneficiaries

Collaborators (UW Stevens Point, UW-Madison, UW Cooperative Extension, WI DATCP, MOSES) on the project gained an increased connection to the Hmong growers and their culture as well as the interests and needs of immigrant fresh market growers. The Ginseng Board of Wisconsin obtained help in reaching their Hmong growers, which comprise about 25% of the ginseng growers in the state (35 growers). Previously, this group of growers were not connected with the Board, which not only provides educaitonal opportunities, but deals with regulatory and marketing issues for ginseng. As a result of this project, a Hmong representative now serves on the Ginseng Board and Hmong ginseng growers are now participating in field day educational events. 135 Hmong growers learned new information to improve their operations, as indicated by the evaluation results. Three Hmong community organizations gained knowledge of resources that can help their members who have fresh market produce operations. All small to medium fresh produce growers across the United States have access to the newly updated growers guides, written in plain language, and available at low or no cost on the web or through the UW-Extension publication store. The guides are available for salad greens; tomatoes; onions, leeks & garlic; squash and pumpkins.

V. Lessons Learned

This project had a number of challenges. We discovered that the Hmong population is not accustomed to committing in advance for workshops or conferences. They are inclined to change their plans at the last minute, which makes it difficult to plan for the number of people attending. It also takes a lot of outreach effort to get registrations and attendance for workshops. This includes written invitations and personal telephone calls just days before the event. Hmong people are more likely to come to events held in places like Hmong community centers rather than extension offices or hotel meeting rooms. There is a lot of distrust among this group of government organizations and a fear that we would report their earnings to authorities. Hmong people are also not accustomed to keeping records of any kind. We have needed to make a number of revisions to how we teach farm record keeping to get information to a level that can be understood and utilized. We thought that after offering smaller workshops, this target group would be ready for a conference. In addition to being able to offer more subjects over a larger period of time, we thought that a conference would bring in more people, helping us to meet our goals. We did charge a small fee ($20) to register for the conference in hopes that we could get some commitment from growers and to help us with planning. (100% of the fee was used to pay for expenses not covered by the grant, specifically lunch and refreshments and printed materials not reimbursed by the grant.) However, people came who didn't register and we did not attract large numbers. In fact, participation was no higher than at smaller workshops. We've gone back to offering workshops at no charge (and not providing refreshments or obtaining other funds to cover their costs). Another challenge we had was that one of our outreach specialists died suddenly. It was hard to refill his position in terms of finding someone who wanted to do the job and had the background to do the job.

It is critical to have people who are knowledgeable about the fresh market vegetable production, speak the native language of the ethnic group you are targeting, and have a thorough understanding of the culture and how to work with it be the direct contact with the target ethnic group. It is also important to consider literacy levels, even when information is translated. Simultaneous translation for Hmong people was not the best way to approach translation during workshops. There are many English words and terms that have no direct translation into Hmong

and have to be explained. We abandoned simultaneous translation early on and had interpreters translate after the speaker completed a thought. This method takes more time (you can cover less information in a given time), but creates better translation of material.

Using pre and post test measures during a workshop for Hmong growers is a bit challenging. We asked them to rate their knowledge before and after participating in the workshop. The data was collected at the end of the workshop, using a likert scale. The Hmong growers had trouble grasping the concept of the likert scale and the idea of measuring what they knew before and after the workshop, despite having the instrument translated verbally or in writing in Hmong. Another challenge was that the new Hmong outreach specialist didn't apparently adequately understand the purpose of the measurement tool as he changed the questions (to questions about comfort at the workshop, likelihood of coming to another one, and very general understanding of the topic) and therefore, the results for those workshops were not meanigful. Those evaluations were not included in the above reported results. We'll do more training with this individual to correct this problem for future workshops.

Milwaukee 3/11/10 Financial Record Keeping
14 evaluations

	Knowledge Before	Knowledge After
Basic financial record keeping	1.57	3.43

Green Bay 3/18/10 Selling for Profit (2 evaluations)

	Knowledge Before	Knowledge After
Knowing different types of production costs	1.5	2
Understanding profit margins	1.5	2.5
Knowing different types of price strategies	2	2.5
Knowing different types of markets	1	2

Wausau 3/27/10 Selling for Profit (19 evaluations)

	Knowledge Before	Knowledge After
Knowing different types of production costs	2.1	3.3
Understanding profit margins	2.2	3.3
Knowing different types of price strategies	1.9	3.3
Knowing different types of markets	1.7	3.2

Wausau 4/17/10 Risk Management & Record Keeping (4 evaluations)

	Knowledge Before	Knowledge After
Understanding different types of risk	2	3.5
Knowing how to manage risks	2.75	3.75
Understanding bookkeeping	2.75	4
Handling your farm business records properly	2.75	3.75

Madison 7/12/10 Organic Production & Certification (12 evaluations)

	Knowledge Before	Knowledge After

A farmer must meet certain rules in order to label their produce as organic.
2.38 4.0
Organic certification requires a yearly inspection. 2.77 4.23
Money is available from the state to repay organic farmers back for ¾ of the certification costs, a maximum of $750, each year. 2 4

Building organic matter and soil biological life is a foundation of organic farming.
2.6 4.0
Organic farmers till in cover crops to improve soil fertility, control weeds and manage pests.
2.46 4.0
Organic farmers must try cultural, mechanical and biological practices and find them ineffective before they are allowed to use approved products to control pests and weeds.
1.77 3.96
Organic farmers are allowed to spray natural products and some synthetic products.
1.77 3.46

Sheboygan 10/23/10 Organic Production & Certificaiton (11 evaluations)

	Knowledge Before	Knowledge After
Understanding the word "organic" and using it properly	1.8	4.2
Knowing how to manage pests, weeds, and plant diseases organically	1.6	4.0
Knowing the methods and inputs used by succesful organic vegetalbe farmers	1.8	3.9
Knowing FSA crop insurance and loan programs	1.4	3.1

Manitowoc 11/6/10 Healthy Soil Healthy Plants (7 evaluations)

	Knowledge Before	Knowledge After
Understand where plants get nutrients, water & oxygen	2.4	4.1
Knowing the primary function of the soil	2.7	4
Understanding soil sample testing	2.7	4
Knowing FSA crop insurance and loan programs	3.1	3.8

Eau Claire Organic Vegetable Grower's Workshop 4/16/11 (7 evaluations)

	Knowledge Before Workshop/Event	Knowledge After
A. Knowing Farm Service Agency loan programs and services	1.4	3.3
B. Understanding the word “organic” and using it properly	2.4	3.6
C. Knowing how to manage pests, weeds and plant diseases organically	2.4	3.6
D. Knowing methods used by successful organic vegetable farmers	2.1	3.4

Eau Claire Conference 12/10/11 (9 evaluation)

Evaluation summaries are presented below.

	Knowledge Before Workshop/Event	Knowledge After
1. How to approach buyers for retail, wholesale markets	4.5	4.25
2. How to prepare and package produce for retail, wholesale markets	4.5	4.5
3. Methods of insect control	4.25	4.75
4. Weed control	4.25	4.75
5. On-farm sanitation	4.25	4.75

Written comments were, "Very good learn a lot" & "Good speakers"

Note: Evaluation results suggest that participants didn't learn much, however, the Outreach Specialist felt that they did not understand how to properly score the evaluation as the participants were talking over lunch about how much they learned. They also told the Outreach Specialist that they would tell people how much they liked the event and encourage them to come to future seminars.

VI. Additional Information

The Learning Store link for ordering growers guide: http://learningstore.uwex.edu/Care-C279.aspx

VII. Detailed Financial Reports

Funds were used to pay for Hmong speaking outreach staff, honorariums for speakers on technical subjects, contract work for the growers guides, printing, workshop materials and space rental, and travel expenses (mileage reimbursements) for staff related to program work.

Salary & Fringe Benefits	$ 31,651.73
Travel	$ 1,464.48
Supplies & Services	$ 6,883.79
Expensed	**$ 40,000.00**

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19) WI DATCP – Division of Agricultural Development

Project Title: SavorWisconsin.com

Total Amount Received: $35,000

Date of Award: December 1, 2009

Project Contacts: Nicole Breunig

Report Date: December 31, 2011

I. Project Summary

In recent years, marketing campaigns have become largely internet focused across the nation and world. As consumers turn increasingly to the internet to research products and businesses, and to make purchases, having a web presence has become a core component of most successful business operations. It is therefore essential that specialty crop producers have a vehicle to promote themselves online. However, building and maintaining one's own website can be expensive. SavorWisconsin.com offers a free web presence for specialty crop producers.

As important as it is for specialty crop businesses to have a web presence, it is equally important that consumers be able to easily locate them online. It can be challenging for consumers to find websites if they don't know a farm's name or precise geographical location. Additionally, personal websites are prioritized lower by search engines than, for example, government, university, or library websites. As a state government website, SavorWisconsin.com ranks higher with popular search engines such as Google and Yahoo. For this reason, if a specialty crop producer is listed on SavorWisconsin.com, consumers are more likely to find them online even if that producer also has their own website.

The beneficiaries of this project were Wisconsin's specialty crop producers. There are currently over 1,800 producers listed on SavorWisconsin.com. Approximately 90% of these producers are producers of specialty crops. With the goal of increasing of traffic to the site by at least 10% and a spike in specialty crop producer listings as an outcome, this project benefitted approximately 1,620 Wisconsin specialty crop producers. SavorWisconsin.com also has the most comprehensive listing of farmer's markets in Wisconsin at over 200 markets listed.

Finally, this project also strived to increase consumer nutrition knowledge and consumption of specialty crops by providing an easy way to locate and intereact with these producers and specailty crops and through informative specialty crop features on the site.

This project built on previous work accomplished through funding from the USDA Specialty Crop Block Grant. SavorWisconsin.com was originally developed through a USDA Specialty Crop Block Grant that was made to the Wisconsin Apple Grower's Association in 2003. Since that time, tactics

to promote Wisconsin's specialty crops have been enhanced to improve the utility of the site, largely through funding from additional Specialty Crop Block Grants.

II. Project Approach

DATCP worked with a web agency and partners to develop mechanisms for increased site traffic as well as increased specialty crop producer listings. The top priorities of the grant project were to implement web-based tactics to increase site traffic (link building, utilizing social networking tools, etc.), site optimization (improve search functions, increase visibility and accessibility of specialty crop listings, additions of new specialty crop listings) and utilize data from site tracking tools to increase initial site traffic and repeat visits.

In regards to these three areas, the following work was done:

Web-based tactics to increase site traffic (link building, utilizing social networking tools, etc.): These tactics included building in the ability to share pages and content on over 300 different social media and interactions through the internet. If a producer created a profile on SavorWisconsin.com they could then go to their webpage on Savor, select the share button and then place it on their Facebook page, they could email it to a customer, etc. On the other side, a consumer could have been at a farmer's market, visited a specialty crop producer on savor and then Tweeted about them by using the social meida share button.

On the site optimization side, the major change taken was to improve the search functions to increase visibility and accessibility of specialty crop listings. These actions included improving the query function of the data base through 'fuzzy searching.' Implementing fuzzy searching helps consumers visiting and searching for products because it takes more than what the consumer typed into the search box. A good example of this is plural searches. If a customer typed in cherries, before they would only get a profile that had the exact word cherries, now profiles with the word cherry would also be included. This site optimization also provided a spell corrector to infer what it thought a visitor was looking for if the word was spelled incorrectly or incomplete, like 'cherri'.

The third component of grant work was utilizing data from site tracking tools to increase initial site traffic and repeat visits. In order to look into this area, the site intergrated Google Analytics into the metrics system and discontinued the previous ClickTracks program. This was an important step because the previous tracking system's data was no longer accurate and therefore not reliable to utilize and apply. Once the new analytics were installed in April 2011, and the first month of measures were taken, I found that the site had two pages that consistently caused an error for visitors. With that known we took action to find the problems and correct it for improved visitor usability. From these intitial measures, we did find that the website had a lower visitor rate than the previous program identified, while knowing this new program provided an accurate reading as the industry standard for website traffic meaures, it has provided a strong base from which to analyze and apply new techniques.

For consumer education and outreach of the site, SavorWisconsin.com was able to partner with Alice in Dairyland, Wisconsin's agricultre ambassador, to showcase some of the different specialty crops based on the feature topics of spices, turfgrass, spring greens, peas and beans, broccoli and cauliflower, melons, honey and cranberries, storage vegetables, holiday

flowers/trees, and buying local specialty crops. By partnering on this work these topic areas were not only shared on the website, but also through newspaper and radio interviews that Alice in Dairyland did throughout 2011. Additionally, the website advertised in the Farm Fresh Atlases across the state to promote the website's availability to specialty crop producers and consumers. While all promotional efforts focused on specialty crops, outside funding sources were used to offset site costs for non-specialty crops so as to ensure that SCBG funding would be used to benefit only specialty crops and no other products.

III. Goals and Outcomes Achieved

The activities that were related to the goals measured included the tactics to increase traffic, site optimization, incorporation of the site tracking, and the promotion of specialty crops through features and advertising.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.

Based on the SavorWisconsin.com grant application, the following mesaures were established.

Goal 1: Increase site traffic

Performance Measure: Web agency will collect monthly page view data from site data tracking tool, Click Tracks, and report to SavorWisconsin.com personnel
Benchmark: Increase number of page views by 10% in 2011
Target: 1,085,026 page views in 2011
Results: Because the measuring tool was changed to Google Analytics in April 2011 we are now comparing apples to organges because the two measures are not the same. However based on the numbers available, the website did have 1,613,311 page views in 2011, exceeding the target. But more importantly, because of the change the website is now using the industry recongined leader in website analytics. Furthermore, we can now see from where the searches and interests are coming from, what information and/or links are driving visitors to the website and can apply this knowledge to enhance the overall impact of the website for years to come. In October 2011 the website had 44,923 visits. While the tracking was not in place for the entire year, the total visits were 364,889.

Goal 2: Increase number of specialty crop producer listings

Performance Measure: SavorWisconsin.com personnel will record the number of specialty crop producers listed on SavorWisconsin.com on a monthly basis
Benchmark: Increase specialty crop producer listings by 10% in 2011
Target: 1,440 specialty crop producer listings in 2011
Results: As of December 31st, 2011 of the over 1,800 producers on SavorWisconsin.com. 1,620 of these are Wisconsin specialty crop producers, almost 90% of the site profiles.

IV. Beneficiaries

The direct beneficiaries of this project were the 1,620 Wisconsin specialty crop producers listed on SavorWisconsin.com.

An economic impact of this project is most readily measured in terms of producer savings on website development and maintenance. The potential for economic savings to the specialty crop

industry is over $2,400,000 for the coming year as these 1,620 producers had the savings on the estimated cost for website development and hosting at $1,500/producer.

Additional economic benefit resulted from increased consumer awareness of where to find Wisconsin specialty crops. By increasing exposure through this project with over 364,889 visitiors to the site, the exposure to drive up sales for producers, thereby strengthening Wisconsin's rural economies and increasing the sustainability of specialty crop farm operations is there. While the potential economic benefit to producers is clear, this component is not measurable.

Finally, this project increasef consumer nutrition knowledge and consumption of specialty crops. This objective was accomplished through informative specialty crop features and educational efforts by Alice in Dairyland. We have no way to measure how many people encreased their knowledge and consumption through the site but even if only 10% of site visitors did so its still over 36,000 people.

V. Lessons Learned

The internet continues to change and evolve, which allows consumers to adapt and utilize it to the fullest. While these opportunities are great, it requires websites to continually stay abreast of the changes and demands occuring in order to keep the site, technolgy and tactics relevant.

However these changes hold real opportunities because the focus of the site is getting producers and consumers interacting about speciality crops. With this new technology come potential opportunities for the website to embrace. This integration will continue to lead the site as a cutting-edge force that builds food relationship for Wisconsin specialty crops.

VI. Additional Information

The next 2 pages are from the www.savorwisconsin.com site.

VII. Detailed Financial Reports

The budget was expended based on the intitial grant application however alternative funding was found for salary and fringe so some of those funds were reallocated to a new project and some were returned to the USDA. $14,526.75 was spent on contractual costs with Skyline Technologies and $1,450 on promotional costs for advertsing in the Farm Fresh Atlases across the state for a total of **$15,976.75** spent on the project. As a match, $30,000 was supplied in equiptment, supplies and contractual services and $18,960 was matched in salary.

VIII. Contact Info:

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Savor wisconsin.com

SavorWisconsin.com is home to over 1,650 producer profiles, hundreds of local food retailers and restaurants, the largest listing of farmers' markets and features the breadth of agriculture products that Wisconsin producers and companies offer.

From the food you eat to the plants, decorations and goods you use—you can find Wisconsin products close to home. Our online directory locates foods and products from across the state with a simple click of the button.

Visit SavorWisconsin.com to find the products you savor from our great state.

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20) WI DATCP – Division of Agricultural Development

Project Title: Specialty Crop Grants Specialist

Total Amount Received: $66,984.82

Date of Award: December 1, 2009

Project Contacts: Jen Pino-Gallagher

Report Date: December 20, 2011

I. Project Summary

The purpose of this project was to facilitate the efficient distribution of funds and the timely review and oversight of the projects funded under the SCBG. This program provided important funding to improve the profitability of Wisconsin's specialty crop industry. The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) provides the staffing resources that facilitate the distribution of these funds to this state. Department staff provide outreach on the program, review submitted proposals, prepare the application for USDA, develop contracts and administer the grants. In addition DATCP staff provide oversight of the program and reports to USDA.

When the SCBG program first provided funding to Wisconsin in 2007, paperwork and reporting was handled by state-funded staff. However, during the 2007-2008 years, the workload associated with the grant review, tracking and reporting significantly increased. Each industry grant lasted two-to-three years, and as each additional grant cycle was added, the number of grants to be tracked increased. More importantly, the 2008 Farm Bill established a significantly larger SCBG appropriation for 2009 through 2012 that allotted several times what the funds had been in past years. This increased the average number of awards from 7-9 annually to about 20 annual awards. The program quickly become something no longer manageable with current DATCP staffing. It was clear that in order to accept the SCBG funds that greatly benefit Wisconsin's specialty crop industries, a dedicated staff member was needed to administer the program. Since the 10% allowed by the USDA for overhead is not allocated to the managing division, we needed a grant to pay for the SCBG Manager position.

II. Project Approach

This position has been extremely effective, making a position impact on our Specialty Crop Block Grant program. The in first year of the grant, The Grants Manager has focused organizing the management of the grant logistics and requirements. Accomplishments included

- creating an excel spreadsheet system to tract invoices and reports for each year's SCBG sub-recipients.

- using the Microsoft Outlook task feature to send reminders to all sub-recipients for report due dates.
- working with the University of Wisconsin System billing staff to create an agreed-upon system for expense explanations. That system is now being followed by the university staff which is making expense accountability much easier for grants through that institution than in the past.
- hiring a finance person who works directly with all SCBG expenses so coordination of the expenses between the DATCP finance staff and Grants Manager has become much more streamlined as well.

Some efforts were also made to build a rapport with specialty crop industry sector members. Having a dedicated staff member in this position allowed us to devote time promoting the SCBG program throughout the state. We also presented grant writing workshops and gave individual attention to applicants to help them hone their projects to increase the quality and quantity of applications and funded projects.

In the second year of the grant, the Grants Manager focused on continuing to build strong relationships with specialty crop industry sector members by attending grower meetings, field days and conferences, and having more communication with grower group staff. Particular efforts have been made to work with the larger groups to help streamline application processes for the multiple applications they submit for each grant year and to encourage small struggling grower groups with tiny budgets and small membership to apply for grants to help strengthen their organizations. We again spent time preparing to implement grant writing workshops and outreach to under-represented applicants.

We began site visits to some of the recipients for more in-depth project evaluations and to help increase communications with grantees who appear to struggle somewhat with their projects. 2010 was spent creating the tools needed to streamline and improve tracking and management of the reporting and invoicing processes. 2011 was spent building relationships to improve the number and quality of proposals received, and diversify the types of recipients and projects funded. With a consistent staff member to run this program we were also able to change some of our granting processes and regulations to greater benefit the projects and recipients that we were unable to manage before the Grant Manager came on board. These include extending the grant period back to a three year cycle instead of the single-year process we had the past 2 years, as well as reducing the maximum and minimum grant request so we can allow for higher numbers of awarded grants should their applications warrant fulfillment. We are pleased that having a dedicated SCBG Manager truly improved the quality of projects and nature of the relationships with specialty crop groups in Wisconsin. We are not sure we could have continued to manage this program without this grant funded position.

III. Goals and Outcomes Achieved

Goal I: A primary goal for this position will be to develop a comprehensive database to use for tracking the SCBG awards, reports, reimbursements and evaluations. This goal was completed in April 2010. Main tracking is through integrated Excel spreadsheets which keep track of all expenditures and reporting. Having all the information in one system that sends reminders automatically has easily saved 20% of staff time tracking all the information.

B. Provide a comparison of actual accomplishement to the goals established for the reporting period.
The original intent of this position was to make the Specialty Crop Block Grant program manageable and all done by one person. However, the position has grown beyond the goal of just managing the paper trail to enhancing the quality of the program and the projects it funds. Much work has been done in late 2010 and in 2011 to build relationships and provide outreach so new groups can apply and receive grant funding along with the tradition organizations that have benefitted from the SC BG funds in the state of Wisconsin.

IV. Beneficiaries

Since the Grant Manager works only on this program, she has been able to provide more assistance to grantees than was otherwise possible. She has also obtained more complete reports and evaluation information from grantees than was completed in the past. This has benefitted all our grant recipients and the USDA staff who work with the SCBG program. We have increased our number of applicants from 9 in the 2008FB to 50 in 2010. We also reduced the number of applications that were not actually eligible for funding or whose proposals were highly unlikely to be funded from 26% of applications in 2009 to just 2% of applications in 2011. We received applications from 18 new entities in 2010 and 2011 and reached out to 37 new individuals or entities in the 2011 for potential applications. The Wisconsin Specialty Crop Block Grant program is no longer something for just our top ten state specialty crop associations but a potential funding source for innovative research, marketing and education promotion for a diverse range of specialty crop entities throughout our state.

V. Lessons Learned

The biggest oversight for this project was not including any travel for the budget. This made it difficult for the Grants Manager to do any outreach outside of a telephone. We did apply and received a follow-up grant in 2010 for the Grants Manager so we were able to use those funds in 2011 for some travel opportunities which helped our outreach efforts in site visits and attending grower meetings for promotion of the grant and to work one on one with grower group staff to help them develop projects and proposals.

Another difficulty was experienced with turnover in key staff positions which made accurate and consistent communication with the Specialty Crop Block Grant Manager and other key management staff difficult. Because of miscommunications between staff, we ended up requiring an amendment to our budget at the end of the grant cycle and had leftover money we turned back into the USDA. Had better communication taken place, we could have easily redirected the funds toward other award recipients who would have increased the impact of their project results with the additional funds. Luckily, we have used these difficulties to put new measures in place to ensure that these problems do not come up again, regardless of staffing situations.

One of the biggest successes has been the increased interest in the grants and the greater diversity of applicants mentioned in the beneficiaries section. While we have strengthened our relationships with longer-term repeat recipients, we still struggle with some grantees to receive

their reports on time or with enough information. It seems the obvious answer to this problem is to terminate their grants or disallow for future grants but their inability to write reports for our grant seems inversely proportioned to their ability to carry out fantastic projects with great outreach for project results with their grower groups. As we move forward with our 2010 and 2011 grants for this project, we will continue to explore new tactics for getting what we need from recipients without jeopardizing their ability to implement some of the most effective uses of SCBG funds.

VI. Additional Information

None

VII. Detailed Financial Reports

The entire grant was used to cover salary and fringe for the Grants Manager at a total of $66,984.82.

VIII. Contact Info:

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2011

Specialty Crop Block Grant Pea Harvester Head Test Results

Oxbo findings pursuant to " Cultural Practices to Accelerate Adoption of Sustainable Insect IPM in Wisconsin and Upper Midwest Processing Pea Production" Block Grant objectives

Brian Maul
Oxbo International Corporation
10/14/2011

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Introduction:

This report serves to collect, highlight, and summarize the test results performed with the use of two Oxbo pea harvester picking heads.

Testing Objectives:

- To define and analyze vacuum, airflow and material flow characteristics within Oxbo "stripper" type pea harvester heads.
- To evaluate the findings gathered during the test in order to make a determination if potential improvement opportunities exist. These opportunities could serve as the core of additional future tests focused at minimizing the ingestion of pests and foreign materials (Material Other Than Peas/"MOP").

Executive Summary:

The January 14, 2011 meeting of the SCBG (Specialty Crop Block Grant) project team resulted in a revision of Oxbo International Corporation's duties and commitment for fulfillment of obligations related to the SCBG. Whereas Oxbo's original commitment to the project had included design and development of additions and enhancements to the picking head component of pea harvesters, the revised commitment was to analyze airflow, vacuum and material flow characteristics of Oxbo's two pea harvesting head designs, the 156/4040 and the 4159.

In the pea processing and harvesting industry there has been theory and conjecture that there are vacuum, pneumatic or dynamic airflow forces occurring within stripper type picking heads that affect a head's efficiency and tendencies to ingest foreign material. The goal of this test series was to utilize a variety of instruments; data collection devices and visual observations to confirm or refute commonly held assumptions about these types of pea harvesting heads and determine what improvements can be implemented based upon the results. The tests were conducted covering the full range of normal and extreme settings and operating speeds for the heads.

Based on static and field tests, air flow through the head is minimal and has very little or no effect on debris or foreign matter that is in the path of the picking reel. Vacuum levels at the soil surface are insufficient to pull foreign material off the ground as illustrated by the static vacuum tests being insufficient to move grass seed on a concrete surface and as shown in field video recording showing material falling to the ground and little or no material being lifted from the ground. All stripping and material movement is due to physical interaction of the tines (picking fingers)and plant material. Any material other than peas being ingested by the stripping reel is a function of being mechanically picked up by the picking fingers or by the resulting vine matter pulling foreign matter along with it as part of the normal harvest process. Without physical contact by the tines (picking fingers) or subsequent harvested material, no test sample material was moved or ingested in these tests. The amount of MOP found in the harvested peas is directly related to the amount of debris present in the field and the flatness of the ground when the field is prepared before planting. Further operations in the field during

the growing season also create field conditions that allow the tines (picking fingers) to pick up dirt and debris at harvest.

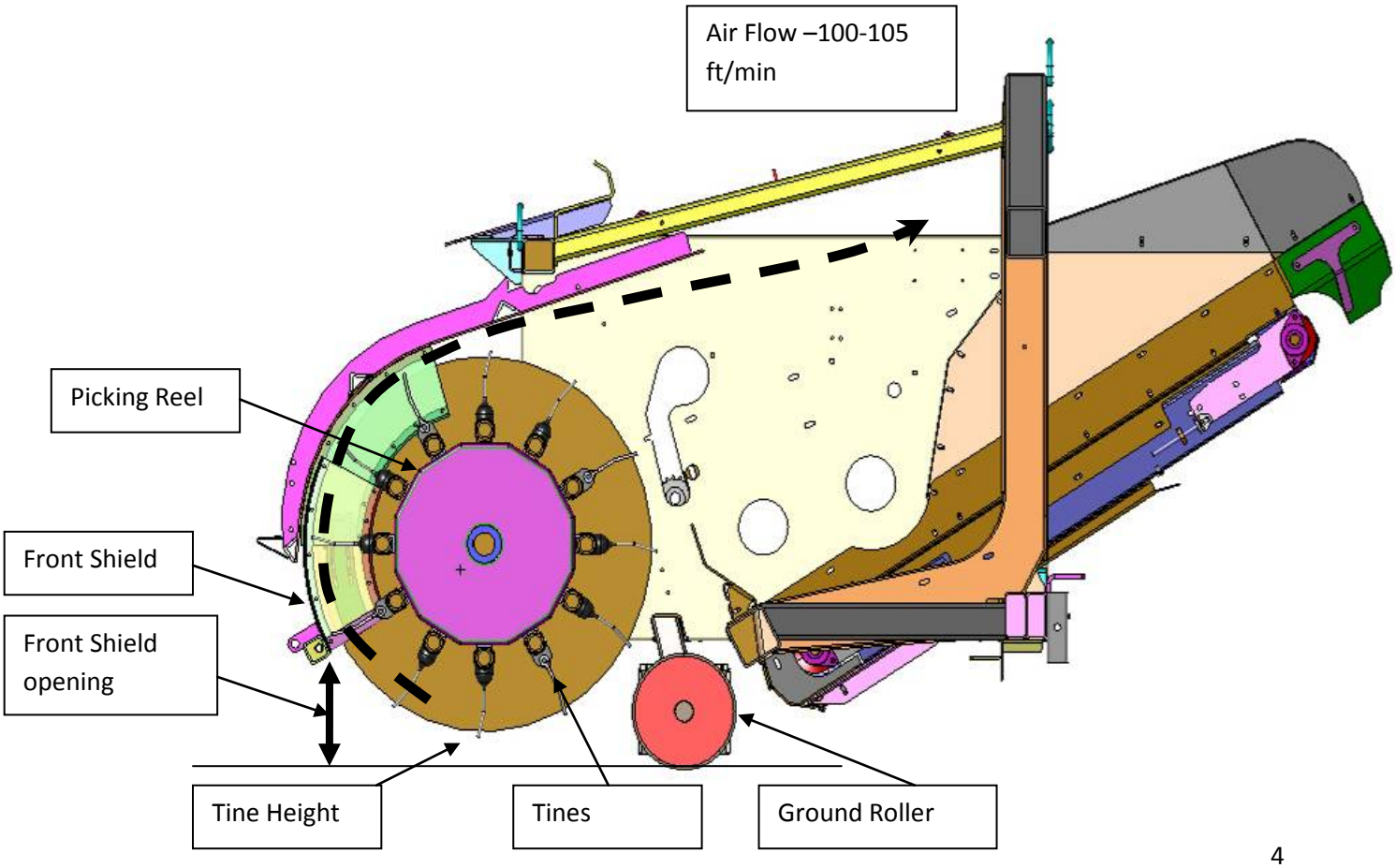
The performance of the Del Monte designed and installed “Bug-Knocker” brush was observed to have the potential for positive results in reducing picking head ingestion of flying and crawling insects. Several insects were shown to fly out of the crop ahead of the picking due to being disturbed by the brush’s interaction with the plant material.

Terms and Definitions:

Static Testing – The combine is running and the head is in operation at the designated speeds but the combine is standing still and testing is on concrete

Dynamic Testing – The combine and head are operating in the field and while harvesting peas.

MOP – Material other than peas



Test Plan Overview:

- Testing performed on 2 different harvesters
    1. Del Monte Foods owned 2440 pea harvester with 4159 head in WI
    2. Oxbo owned PSC156 pea harvester with 6156 head in NY
- Preparation of Del Monte owned 2440/4159 for test to be performed by Oxbo personnel at Del Monte's Coloma, WI Ag shop.
    1. Static portion of testing to be performed at the Del Monte Ag shop
    2. Dynamic/Operation testing to be performed in Del Monte production pea fields near Coloma, WI
- Preparation of Oxbo owned PSC156/6156 for test to be performed by Oxbo at Oxbo's Byron, NY facility.
    1. Static portion of testing to be performed at the Oxbo facility
    2. Dynamic/Operational testing to be performed on Oxbo contracted test plots at a local grower's operation adjacent to Oxbo facility
- Test instrumentation included:
    1. Shaft Speed: Shimpo DT205B meter
    2. Vacuum/Air Flow: Dwyer Digital Manometer Series 475 Mark III
    3. Dynamic Airflow : Kestrel 4200 Pocket Air Flow Tracker
    4. Video: High Speed Camera -Casio EXILIM 60 fps

- Other supplies included:
    1. Lighting to illuminate high speed video subject areas
    2. Chalk lines & markers to create visible 6' x 12' grid layout on floor
    3. Grass seed for detection of airflow patterns
    4. Smoke generators for visualization of airflow/vacuum patterns

Results and Discussion:

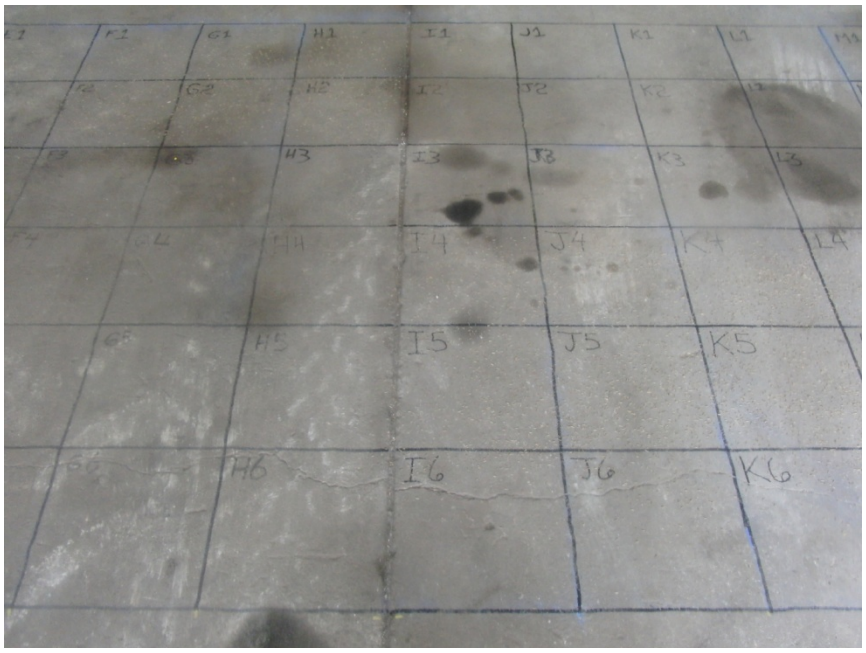
4159 Testing:

Wisconsin Testing with Del Monte owned 2440/4159 pea head

Static Tests

1) Air Flow Measurements: Air flow induced by the picking reel operating at normal harvesting speeds was not accurately measurable using the digital manometer due to being too low of value for the instrument. The air flow velocity was measured with the Kestrel turbine style anemometer.

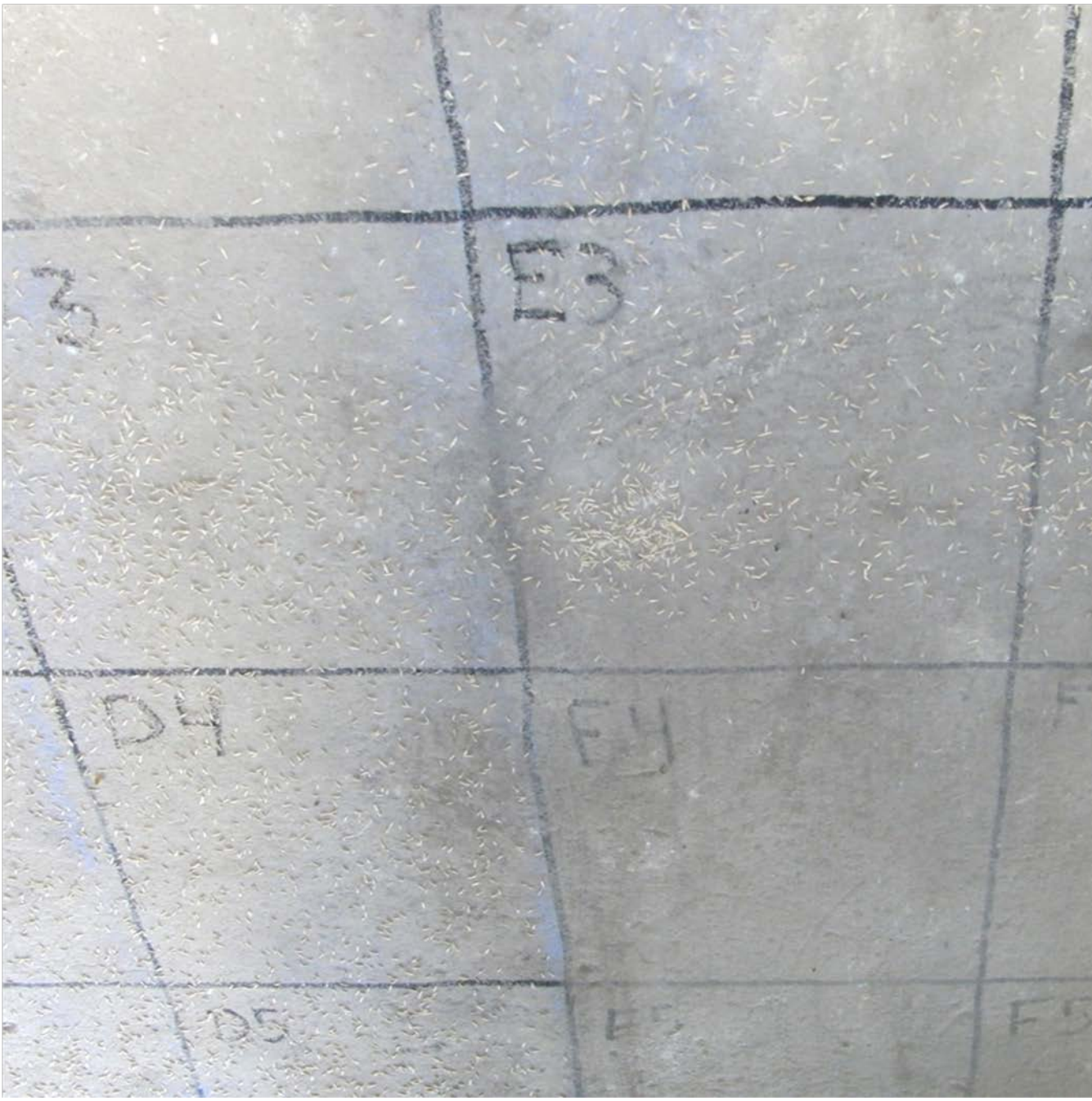
2) Material Pick up Test:
   Description – Grid drawn on concrete floor – 12”x12” squares total 6x12 grid
   Each grid square is numbered
   Grass seed was added to the grids as shown



The shaded areas show where seeds were deposited prior to the test. Blank areas were left to capture movement of seeds, if any occurred

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6

Typical seed distribution across row 3 is shown below



The head's picking reel was centered above rows 3 and 4 in a raised position. The head was started and picking reel speed adjusted to the desired value. The head was then lowered until the ground roller rested on the concrete. Air flow measurements were taken, video recorded of movement of material under the head. The picking reel was stopped, head raised and moved out of the way so pictures of the same grid square could be photographed.

Seeds placed on the test grid did experience significant movement on ends of head but not in the middle of the head. It is noted that no seeds were lifted or ingested into the reel. Only lateral movement of several inches of the seed on the concrete floor was observed.

3) Air Flow pattern with video and smoke test: Smoke emitters were used to visually show air flow around the head. A video confirms air flow away from the reel in front of the head across the full width of the reel, and air flow into the reel on the ends of the head. No air flow behind the ground roller was observed. There is a swirling air flow pattern (possibly caused by conveyor belt flighting) under the picking fingers but no strong movement into the head.

WISCONSIN FIELD TEST

During field observation and testing, several high speed video captures were taken of the plant material flow characteristics and the performance of the Del Monte designed and installed “Bug-Knocker” brush. During review of the high speed videos, the bug-knocker did exhibit some positive results. Several insects were shown to fly out of the crop ahead of the picking by being disturbed by the interaction of the powered brush with the plant material. It appeared that with relatively minor modifications in the construction of the brush, it could be less prone to wrapping or pulling on the vine mass while still having a positive effect at disturbing the bugs. The position of the brush as shown in the above photo should be considered to be as rearward to the picking reel as practical and yet still allow for enough time for the insects to fly out of the crop and away from the stripping reel. It could be beneficial to increase the distance between the brush and the picking head.

4159 Testing Summary:

Based on the static and field tests the air flow through the head and around the picking reel is minimal. There is virtually no vacuum being created capable of pulling material off the ground. All stripping and material movement is due to physical interaction of the picking fingers and plant material. Any material other than peas is introduced by the material being mechanically picked up by the picking fingers. Without physical contact, no material was observed to be picked up in these tests.

4040 Testing:

Test Report for New York Head Testing of 6156 head on 2005 PSC

Testing was completed in two parts –
Static testing: the head operating on concrete in the shop – complete July 23, 2011
Field testing: the head operating in pea crop – complete August 2, 2011
The head was modified as shown to add viewing panels and access points to measure air flow and record video of the operation.

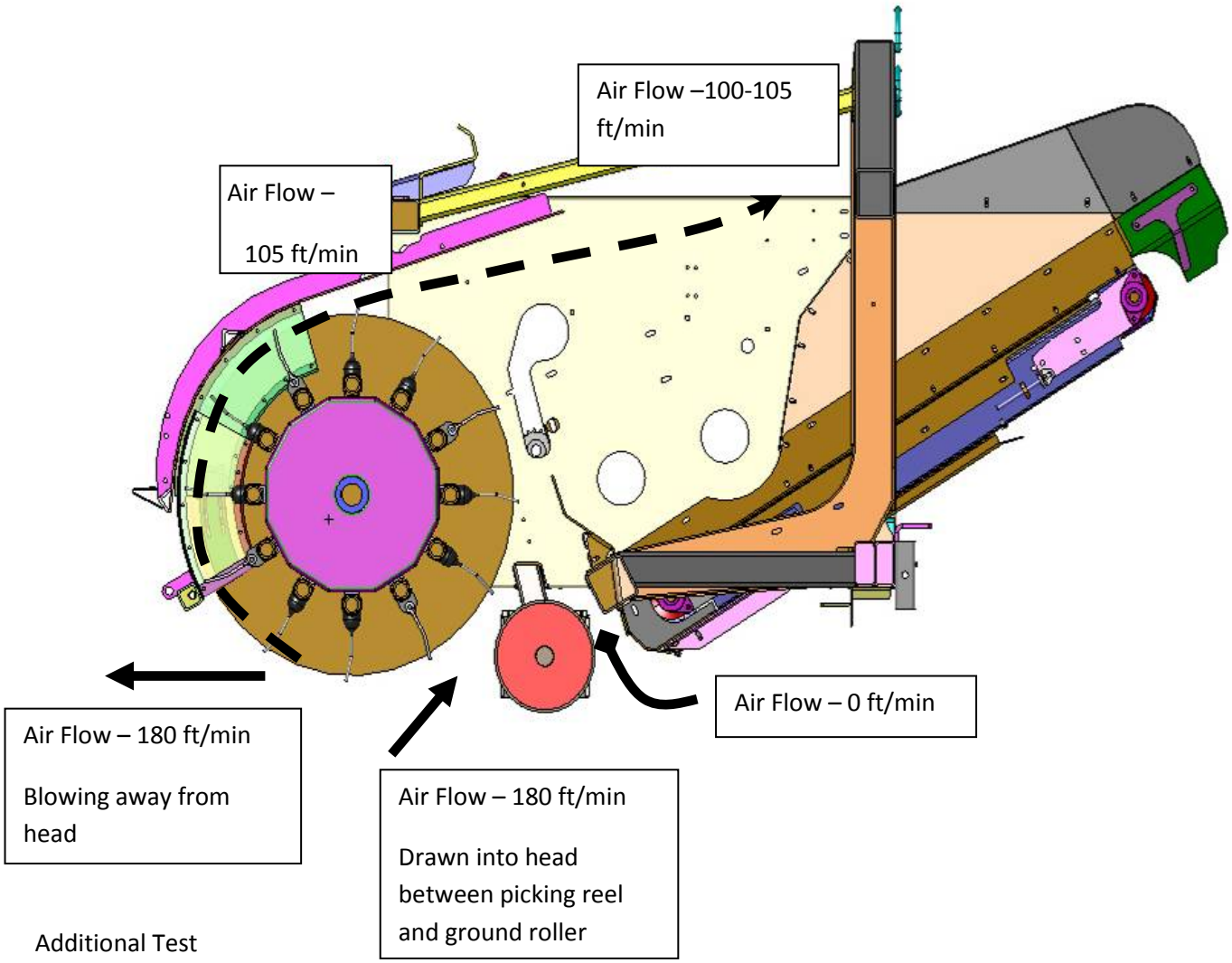
Test equipment:

Shaft Speed:	Shimpo DT250B meter
Air Flow:	Dwyer Digital Manometer Series 475 Mark III and Kestrel 4200
Air speed:	Kestrel 4200 Pocket Air Flow Tracker anemometer
Video:	High Speed Camera -Casio EXILIM 60 fps
Lighting:	Add lights to shine thru panels

Static Tests

4) Air Flow – Air flow was to be measured using the digital manometer. The air flow was found to be too low at all picking reel speeds to register on the manometer. The air flow was measured with the Kestrel turbine style anemometer.

   Picking Reel Speed – 186 RPM
   Picking fingers at mid height
   Front shield ½ open



Additional Test

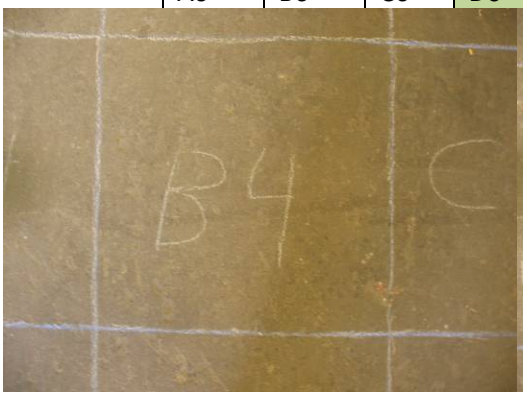
Picking Reel 139 RPM,
Minimum Picking finger Height
Front Shield Full down
Air flow away from head in front of picking reel – 238 ft/min
Air flow above picking fingers in head - 156 ft/min

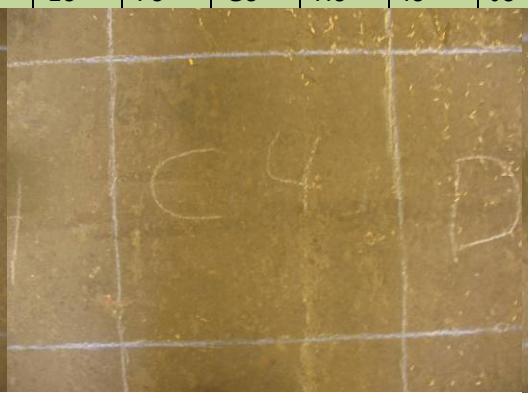
Pea Head Test

Material Pick up Test
Description – Grid drawn on concrete floor – 12”x12” squares total 6x12 grid
Each grid square is numbered
Grass seed was added to the grids as shown

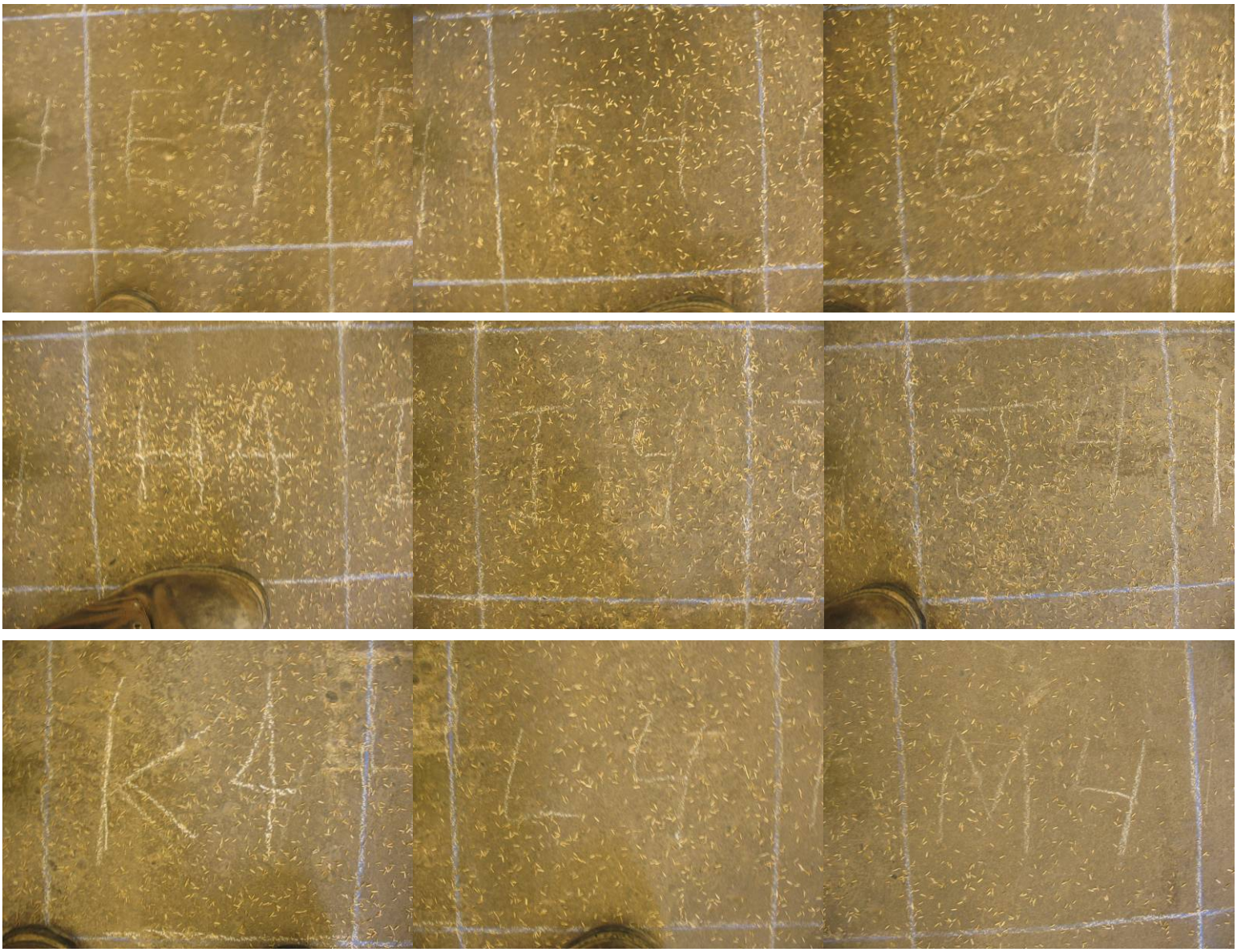
The shaded areas show where seeds were distributed. Blank areas were left to capture moved seeds if any occurred.

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6





Pea Head Test



The head's picking reel was centered above rows 3 and 4 in a raised position. The head was started and picking reel speed adjusted to the desired value. The head was then lowered until the ground roller rested on the concrete. Air flow measurements were taken, video recorded of movement of material under the head. The picking reel was stopped, head raised and moved out of the way so pictures of the same grid square could be photographed.

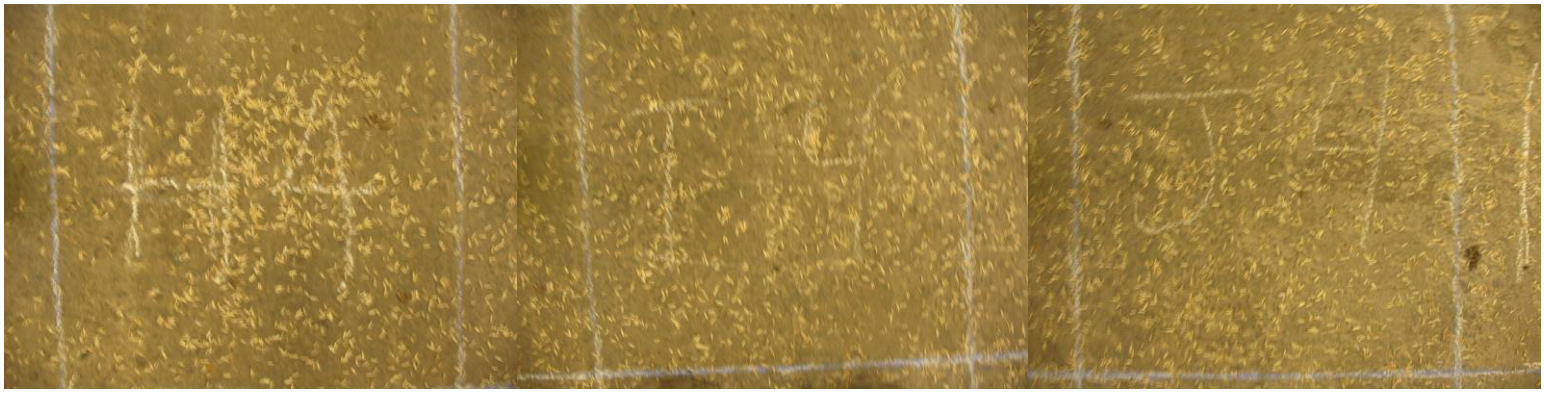
Results of three speed tests

a) Picking reel speed – 139 RPM
   Picking fingers full down
   Front shield closed – air flow 238 ft/min
   Front shield full open – air flow 135-186 ft/min

Pea Head Test

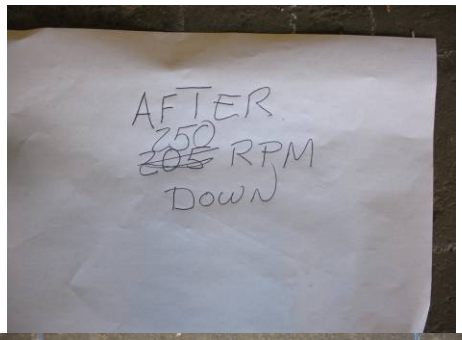
No Movement of any seeds – across floor nor lifted into head

b) Picking reel speed – 205 RPM
Picking fingers full down
Front shield closed - air flow 325 ft/min
Some seeds moved – less than an inch and only when struck by a picking finger.
Effect on seeds are shown below

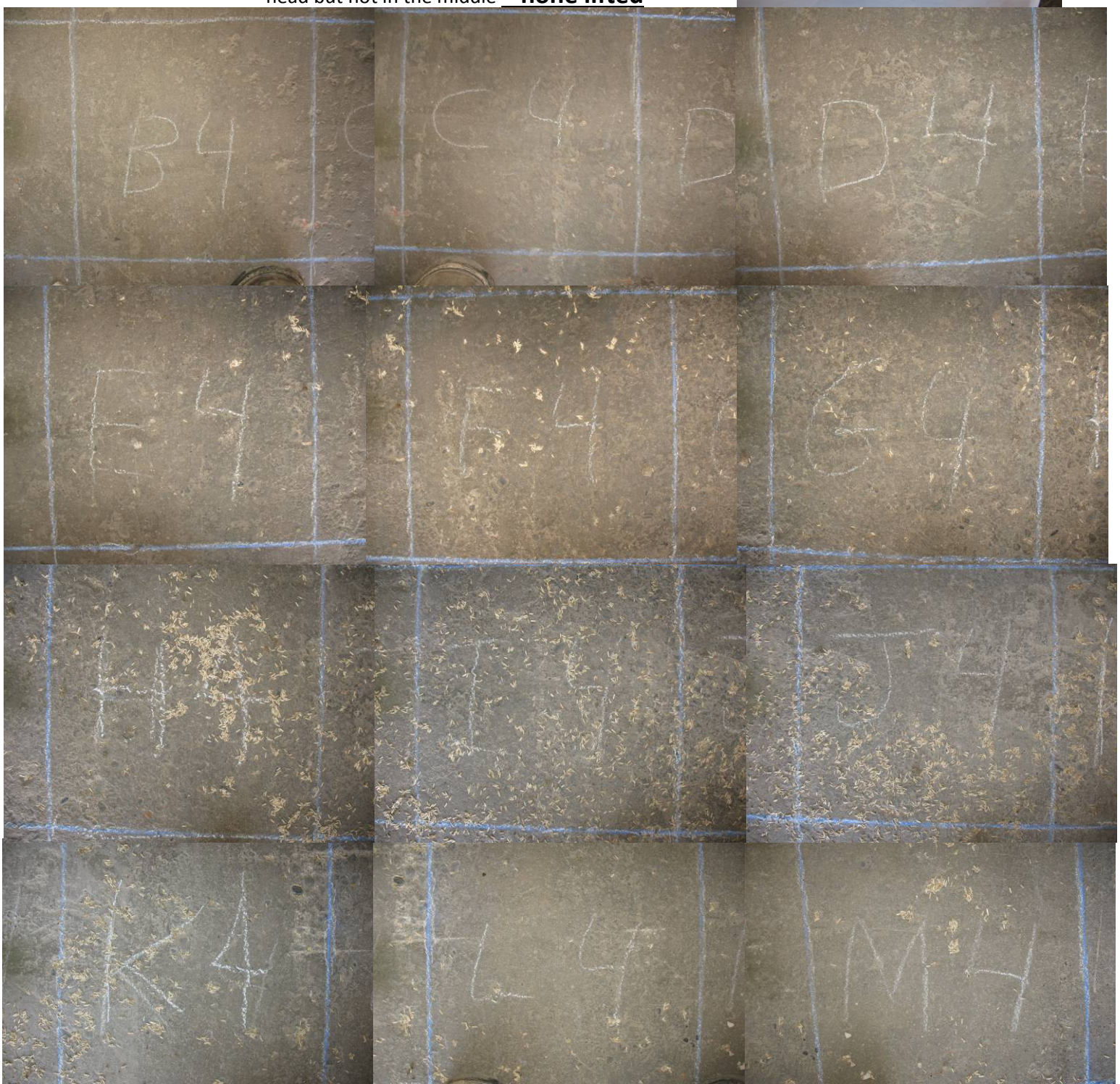


Pea Head Test

c) Picking reel speed – 255 RPM – maximum picking reel speed possible
Picking fingers full down
Front shield closed - air flow 370-425 ft/min
Air flow above auger 150 ft/min
Air flow sucked into the end of the head behind the picking reel – 265 ft/min
Effects on seeds are shown below.



Significant movement forward of seeds on ends of head but not in the middle **– none lifted**



5) Air Flow pattern with video and smoke test.
   Smoke emitters were used to visually show air flow around the head. The video confirms air flow away from head in front and air flow in on the ends. No air flow behind the ground roller. There is swirling under the picking fingers but no strong movement into the head.

New York Field Tests

Oxbo had contracted and planted peas specifically for these tests. 1 acre of Bolaros and 1 acre of Aphilla type peas were planted. Due to a very late plant date and lack of rain the Bolaro variety all died before the test. Photos of this test planting are shown below. Planting was in strips with alternating crop types.

Field conditions at time of test:
Temperature 91.5 F
Humidify 46.2%
Dew Point 67.3 F
Wet Bulb 73.2

Pea Head Test

Barometric Pressure 29.80 in Hg

Test Cases:

1) Picking Reel at 150 RPM
   Test with Picking fingers Down, Shield Down at 1.5 mph:
   Harvested in the direction of the lay of the peas. Very little crop stripped due to lodging. All subsequent tests harvested opposite pea vine lodging direction
   Video: 6156 Head Field Test1 2Aug11.mov Viewed thru plastic – difficult to see

2) Same as #1 except harvesting in opposite direction in peas
   Video : 6156 Head Field Test2 2Aug11.mov Viewed thru plastic
3) Picking Reel at 150 RPM
   Picking fingers Up to **2**"
   Shield Down
   1.5 mph
4) Picking Reel at 150 RPM
   Picking fingers Up to **half height**"
   Shield Down
   1.5 mph
5) Picking Reel at **214** RPM
   Picking fingers Up to half height"
   Shield Down
   1.5 mph
6) Picking Reel at **214** RPM
   Picking fingers Up to half height"
   Shield Down
   1.0 mph
7) Same as Test 6 viewed from End of Head
8) Same as 6 viewed in front of head toward reel
9) Picking Reel at **214** RPM
   Picking fingers Up to half height"
   Shield Down
   1.0 mph
10) Picking Reel at **252** RPM
    Picking fingers Up to half height"
    Shield Down
    1.0 mph
    View toward head

    Measured Air flow – 450 ft/mi out front of head, 750 ft/min above reel, 158 ft/min air inflow behind reel at end

Test 15 a-c
Picking Reel at maximum 255 RPM to induce maximum possible vacuum – none found
Picking fingers full down
Shield Down

1.0 mph

Views inside at picking finger level on the ground and thru plastic at side of picking fingers . **15b is the best video**

11) Test 16 a-c

Picking Reel speed reduced to 200 RPM,

Picking fingers lowest

Front Shield is Open ½

Additional testing was completed on 8/4/2011

The reel was set to 188 RPM initially but rose to 200 RPM as the oil heated up.

A test strip was cleared to allow viewing of the side of the picking fingers and toward the ground roller.

12) Tests 12 are the same conditions as above but all video looking toward the picking fingers and ground roller
13) Tests 13 were looking at the picking reel, front shield and live roller inside the head. This was looking for losses thru the open reel.
14) Tests 14 were looking at air flow thru the head using smoke emitters
15) Tests 15 were looking at air flow on a concrete pad using smoke emitters

4040 Testing Summary:

Findings for the 4040 testing had similar results to the 4159 tests. Based on the static and field tests, the air flow through the head is minimal. There is no appreciable vacuum being created to pull material off the ground. All stripping and material movement is due to physical interaction of the picking fingers and plant material. It is observed that any material other than peas that is ingested by the picking reel must first come in contact with picking fingers or be entrained with other plant material being harvested and ingested by the picking reel. Without physical contact, no material was observed to enter the head in these tests.

Conclusions:

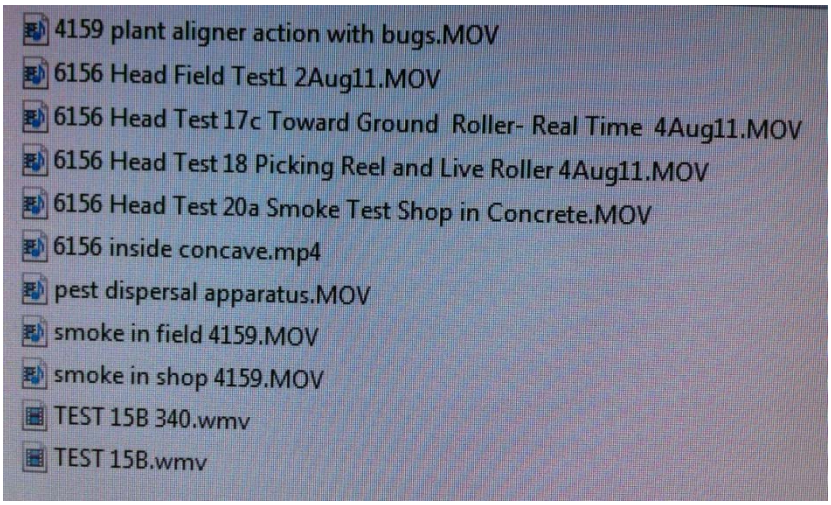
Based on the static and field tests, the air flow through the head is minimal relative to any debris or foreign matter that could be in the path of the picking reel. Vacuum levels at the soil surface are insufficient to pull foreign material off the ground as illustrated by the static vacuum tests being insufficient to move grass seed on a concrete surface. All stripping and material movement is due to physical interaction of the picking fingers and plant material. Any material other than peas being ingested by the stripping reel is a function of being mechanically picked up by the picking fingers or by the resulting vine matter pulling foreign matter along with it as part of the normal harvest process. Without physical contact by the picking tines or subsequent harvested material, no material moved in these tests.

Detailed testing of both versions of Oxbo's pea heads in both static and field operation situations reveals there is no significant vacuum or airflow generated. Ingestion of grit, pests and other EVM & MOP occurs because of physical contact with material being stripped by the picking reels and subsequent conveyance into the harvester's threshing cycle. However, there is some captured video graphic evidence that a mechanical device interacting with the pea vine canopy in advance of the harvester will have at least a moderate effect in reducing the incident of beetle, aphid and flying pest ingestion into the harvester.

Appendix A: Related High Speed Video

Select High Speed video highlighting the static and field tests of the 4159 and 4040 heads and the field operation of the Del Monte installed “Bug-Knocker” are collected onto one DVD, Disk name “SCBG Nov 11 2011”.

Files as follows:



Appendix B: Test Equipment and Test Supplies

Shaft Speedometer: Shimpo DT205B meter

Vacuum/Air Flow: Dwyer Digital Manometer Series 475 Mark III

Pea Head Test

Dynamic Airflow Anemometer: Kestrel 4200 Pocket Air Flow Tracker Anemometer

Residential Fescue Grass seed

Video: High Speed Camera, Casio EXILIM 60 fps

Chalk line

Smoke Generators

West Madison Agricultural Research Station

Brix Readings 2012

Table 6

Date of Ripening	**8/3/12**	**8/13/12**	**8/27/12**	**9/4/12**	**9/11/12**	**9/18/12**	**9/27/12**
Variety Name	Brix	Brix	Brix	Brix	Brix	Brix	Brix
Canadice	16.3	18.5	21.7	20.8	22.2	23.5	22.5
Einset	17.7	19.5	21.8	20.0	21.4		
Himrod	17.2	18.2	20.5	18.7	22.1		
Interlaken	14.3	15.3	16.8	18.3	21.3	20.8	20.3
Lakemont	11.3	15.5	16.0	18.5	18.0	20.0	21.7
Marquis	13.2	15.2	18.0	18.3	20.0		
Mars	15.2	17.5	17.5	17.7	21.3		
Reliance	17.8	18.3	22.0	19.8	20.0		
Somerset Seedless	18.7	21.5	25.0	24.7	26.3		
Trollhaugen	17.5	21.0	24.0	22.7	20.4		
Vanessa	15.3	17.7	19.0	15.5	19.0		
Venus	14.2	15.5	19.0	18.8	18.4		

All varieties pruned to two clusters per fruiting spur

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Table 7

Cluster and Berry Weight 2012

Date of Fruit Wght	9/11/12		9/11/12				
					Data	Data	Data
Variety Name	**Fruit Weight g/Cluster**		**Fruit Weight g/1 berry**		***Cluster Weight g/clster***	***Fruit Weight g/1 berry***	***Tons/ Acre***
Canadice	252		1.9		187	1.6	
Einset	41		2.4		154	2.3	4.5
Himrod	116		2.4		172	2.1	4.2
Interlaken	287		1.7		245	1.5	

Lakemont	275		2.0		220	1.7	
Marquis	153		3.0		245	3.5	10.5
Mars	128		2.8		193	2.6	6.7
Reliance	144		1.8		280	2.3	6.5
Somerset Seedless	137		1.3		149	1.8	
Trollhaugen	107		1.3		225	1.5	
Vanessa	125		2.8		116	1.2	6.0
Venus	221		3.8		250	2.9	8.0

Sizing by UNECE Standards		Open Grown Seedless Table Grapes	
		All varieties excluding small-berry varieties	Small-berry varieties listed
	Extra Class	250g	150g
	Class I	150g	100g
	Class II	100g	75g

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Table 8

Total Fruit Weight and Harvest Dates 2012

	8/13/12	8/17/12	8/23/12	8/27/12	8/28/12	8/29/12	8/30/12	9/4/12	9/11/12	
Variety Name	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Weight - lbs**	**Total Fruit Set**
Canadice	2.56	0.00	4.91	26.20	2.51	1.77	15.46	16.98	3.76	73.57
Einset	0.00	0.00	3.62	22.21	1.63	0.81	0.00	1.69	0.00	29.96
Himrod	0.00	0.00	1.81	20.50	1.49	1.12	0.81	15.75	1.05	42.53
Interlaken	0.00	0.00	4.45	17.23	1.78	2.13	1.48	9.1	4.91	41.08
Lakemont	0.00	0.00	2.93	16.54	2.53	1.94	2.03	12.52	5.62	42.08
Marquis	0.00	0.00	2.46	18.12	1.65	1.68	1.98	3.78	1.99	29.68
Mars	0.00	0.00	4.58	17.50	1.86	1.54	1.52	10.54	5.87	43.41
Reliance	0.00	0.00	3.74	22.00	1.87	1.17	3.81	0.70	0.47	33.76
Somerset Seedless	47.12	4.80	1.94	25.65	1.12	0.51	0.00	3.14	0.94	85.10
Trollhaugen	7.31	5.20	3.69	26.10	1.54	1.43	0.00	4.29	0.58	49.83
Vanessa	2.00	0.00	5.2	19.00	2.81	1.12	6.22	0.00	1.76	29.89

Venus	0.00	0.00	2.66	23.86	2.15	0.5	0.00	12.65	0.58	42.40

		Average of totals		16.07 lbs per vine x 660 vines per acre =						10,606
Total Estimated for 1 acre				16.07 lbs per vine x 600 vines per acre =						9,642
		Average Price/lb		$3.00 lb						$30,789

Variety	2012 lbs/Acre
Canadice	24.52
Einset	9.99
Himrod	14.18
Interlaken	20.54
Lakemont	14.03
Marquis	14.84
Mars	14.47
Reliance	11.25
Somerset Seedless	28.37
Trollhaugen	16.61
Vanessa	9.96
Venus	14.13

Variety	2012 Tones/Acre
Canadice	9.71
Einset	3.30
Himrod	4.68
Interlaken	6.78
Lakemont	4.63
Marquis	4.90
Mars	14.47
Reliance	14.47
Somerset Seedless	9.36
Trollhaugen	5.48
Vanessa	3.29
Venus	4.66

Average			
lbs Per Vine	2012 Tones /Acre	2011 Tons /Acre	
24.52	7.36	5.90	Canadice
9.99	3.00	4.33	Einset
14.18	4.25	4.62	Himrod
13.69	4.11	4.30	Interlaken
14.03	4.21	4.66	Lakemont
9.89	2.97	6.28	Marquis
14.47	4.34	12.58	Mars
11.25	3.38	8.36	Reliance
28.37	8.51	9.21	Somerset
16.61	4.98	7.79	Trollh
9.96	2.99	5.54	Vanessa

14.13	4.24	0.61	Venus
15.09	5.13	6.18	

	Selling Price$3.00
lbs	$31,818
lbs	$28,926

Seedless Table Grape Trial Report 2012

Judith Reith-Rozelle/Brian Emerson/Jenna Lind/Thomas Hickey

Seedless table grapes can be grown in Wisconsin with careful management and selection of varieties for the zones in each area. Breeding programs across the country are releasing new winter-hardy selections and several older hardy Elmer Swenson varieties are once again being planted.

The major limiting factors in producing seedless table grapes in any temperate climate is the ability of the vines to survive the cold, freezing temperatures of northern regions, late spring frost, and fluctuating rain fall. The cropping loads, disease infections, and drought also impacted cold hardiness. Each of these factors stress the plants and decrease the vines ability to strong develop overwintering capacities.

The length of the growing season or ripening period also dictates what cultivars can be grown in regions where the frost-free days may be fewer than 150 days. The growing season is determined by the dates of the first and last frost of any one-year.

This reports identifies the seedless table grape varieties that have been trialed at the University of Wisconsin – Madison, West Madison Agricultural Research Station since 2007. Fifteen varieties were planted in June of 2007. Five years later 12 cultivars are still in the trial and all produced abundant fruit in 20112. Some data is included from past years to show continuity of cultivar.

Seedless Table Grape Cultivars – In Trial Summer of 2012
The following data was collected during the growing season 2012

'Canadice'

- Fruit rose colored, red, mid-size, sweet, complex, spicy taste, 20.8 - 23.5 brix when ripe
- Good resistance to downy mildew/powdery mildew
- Mid-season harvest, held well on vine – 8/23 – 9/11, good storage potential. 2011 harvest continued over a six week period
- Clusters 0.480 to 0.530 lbs. Average vine 18.5 - 24.52 lbs.
- Vines medium vigor
- Medium winter hardiness, good management of fruit load, increases winter hardiness

'Einset'

- Fruit light rose of med-size, very spicy, fruity, clear, clean taste, 20.0 to 21.4 brix when ripe
- Good resistance to downy mildew/powdery mildew
- Early harvest, held well on vine – 8/23 – 9/4, good storage potential
- Clusters 0.338 lbs. to 0.141 lbs., average vine 13.12 lbs.
- Vines vigorous, slow to develop
- Excellent winter hardiness, good management of vines and fruit load

Seedless Table Grape Cultivars – In Trial Summer of 2012

'Reliance'

- Fruit soft rose with blush of green, very beautiful, complex flavors, problem with uniform ripening in 2011, ripe 19.8 to 20.0 brix, brix first harvest 18.5. Ripening problem decreased in 2012 by pulling leaves to expose clusters and decreasing cluster numbers
- Good resistance to downy and powdery mildew, controlled with sprays
- Mid/late season harvest; held well on vine – 9/14 – 10/1
- Clusters 0.340 - .0583 lbs.
- Vines very vigorous
- High winter hardiness

'Somerset Seedless'

- Fruit rose colored, very complex flavor, quite sweet, ripe 24.7 to 26.5
- Good resistance to downy and powdery mildew, any outbreaks controlled by sprays
- Early season harvest, first to ripen, eight harvests – 8/13 – 9/11
- Clusters 0.262 – 0.282 lbs., berries smaller than other varieties
- Vines very vigorous – needs to be on high cordon
- Excellent winter hardiness

'Vanessa'

- Fruit deep rose, red, with very spicy, complex, sweet taste, ripe at 19..0 to 20.0 brix
- Susceptibility to downy mildew low, powdery mildew medium, sprays control outbreaks
- Early season harvest, right after Somerset, eight weeks of harvest 8/13 - 9/11, good storage
- Clusters 0.262 - 0.342 lbs.
- Vines medium vigor
- Good winter hardiness – excellent with good vine management

'Himrod'

- Fruit clear green/white, sweet, clear taste of "green grape", brix20.5 – 22.1
- Good resistance to downy mildew, susceptible to powdery mildew, sprays control outbreaks easily
- Early harvest, harvest from 8/23 – 9/11, excellent storage
- Clusters 0.210 - 0.285 lbs.
- Vines vigorous
- Excellent winter hardiness

Seedless Table Grape Cultivars – In Trial Summer of 2012

'Interlaken'

- Fruit deep green, very sweet with undertones of spices – ginger, brix 20.8 – 21.3, very sweet at lower 18.3 brix
- Good downy mildew resistance, very low susceptibility to powdery mildew, sprays control outbreaks easily
- Mid-season harvest, held well on vine 8/23 – 9/11 lbs., good storage potential
- Clusters 0.325 l – 0.590 lbs.
- Vines medium vigor
- Very good to Medium winter hardiness. Need to manage crop load and canopy for good winter hardiness

'Lakemont'

- Fruit green with no blush, very sweet when fully ripe, brix 20.0 – 21.7, is very sweet at 18.5 brix
- Good downy mildew resistance, very low susceptibility to powdery mildew, sprays control any outbreaks
- Mid-season harvest, held well on vine 8/23 –9/11, good storage potential
- Clusters 0.359 – 0.587 lbs.
- Vines medium vigor
- Very good to Medium winter hardiness., Need to manage crop load and canopy for good winter hardiness

'Marquis'

- Fruit deep green, with light, sweet taste, spicy undertones, Brix18.3 – 20.0
- Medium susceptibility to downy and powdery mildew, controlled with sprays
- Late season harvest, short season harvest 8/23 - 9/11
- Clusters 0.340 – 0.320 lbs.
- Vines Medium vigor
- Excellent winter hardiness

'Mars'

- Fruit deep-purple, a bit astringent, clear fruity taste, ripe 17.7 to 21.3 brix
- Susceptible to downy mildew and powdery mildew, sprays control out
- Mid/late season harvest 8/23/ - 9/11
- Cluster 0.225 - 0.475 lbs., trouble with ripening, manage fruit load
- Vines very vigorous, high cordon
- Excellent winter hardiness

' Trollhaugen'

- Deep purple, spicy, complex taste and very crisp, ripe at 20.4 to 22.7 brix
- Susceptible to downy and powdery mildew, controlled with sprays
- Early season harvest, right after Somerset, good storage potential
- Clusters 0.210 - 0.229 lb., held well on vine 8/23 – 9/11, good storage potential
- Vines medium vigor
- Excellent winter hardiness

'Venus'

- Deep purple, spicy, complex taste and very crisp, ripe at 18.4 to 21 brix,
- Susceptible to downy and powdery mildew, controlled with sprays
- Early season harvest, right after Somerset
- Clusters .229 lb., harvest period 8/23 – 9/11, good storage potential
- Vines medium vigor
- Medium/Excellent winter hardiness

One note on determining ripeness of seedless table grapes; ripeness does not depend on the same parameters as wine grapes. Harvest and ripeness is determined best by tasting, checking color and then a brix test if one wishes to record sugar levels at harvest. Tasting, tasting, and more tasting is the most important parameter in determining table grape ripeness.

Brix levels were taken on all of the grapes above to determine the ultimate sugar levels of all varieties. Brix levels begin to fall when quality begins to decline. With measurements over time, a time-line for harvest extension can be plotted.

For more information on growing grapes and to find a list of future grape training session, check out the following web sites:

- Wisconsin Grape Growers Association web site: http://wigrapes.org
- University of Wisconsin – Madison: http://universitydisplaygardens.com
- University of Wisconsin – Madison: http://www.fruit.wisc.edu

University of Wisconsin — College of Agricultural & Life Sciences
West Madison Agricultural Research Station
8502 Mineral Point Road ■ Verona, Wisconsin 53593 ■ 608/262-2257 ■ Fax: 608/829-3074

MICROPROPAGATION POTENTIAL FOR THE AMERICAN HAZELNUT

Eric Zeldin, Scientist, University of Wisconsin – Madison

August 14th, 2012

One of the major challenges in the development of the American hazelnut as a new crop is the difficulty in clonally propagating selected individuals. In most fruit and nut crops, selected individuals are grafted to produce new plants that are genetically identical. This is not feasible with the American hazelnut because grafting is difficult and the seedling rootstocks produce new stems that will bypass the desired individual anyway. Rooted cuttings can be utilized in many woody species, but trials with the American hazelnut have been variable, usually with a low percentage rooting and poor survival of those cuttings that do root (Fig. 1).

Fig. 1. One rooting test with American hazelnut that yielded only 10% satisfactory rooting.

Micropropagation is the multiplication and recovery of whole plants using an in vitro, laboratory-based system. Micropropagation has been used to facilitate the propagation of many recalcitrant plants, and in the program of Professor Brent McCown at the Horticulture Department of the University of Wisconsin - Madison, we have been working with this type of woody plant biotechnology for over thirty years. As participants in the Upper Midwest Hazelnut Development Initiative, we are applying this expertise to the micropropagation of the American hazelnut.

Why do micropropagation? There are many advantages and very few drawbacks to micropropagation. With micropropagation we can:

- Propagate anytime, independent of weather, climate and location.
- Propagate much faster, achieving exponential increase once cultures are established.
- Propagate free of pests and diseases.
- Produce extremely uniform plants.
- Produce plants that grow and establish faster than those obtained from conventional cuttings.

However, micropropagation is not always successful and it can be quite expensive due to the costs of specialized equipment, supplies and personnel required. Research is necessary to overcome these difficulties.

Our specific goals in micropropagation research with the American hazelnut at this point in time are: 1) to perform clonal propagation to allow horticultural research (mulching, fertilizing, pruning, etc.) uncompromised by the genetic variation present with seedling plants, and 2) to facilitate the selection and development of elite individuals for enhanced yield and ease-of-culture through replicated clonal trials. This article describes in text and pictures our initial efforts towards micropropagating the American hazelnut, from selected parent plants to hundreds of genetically identical, field-ready plants.

The process started with the selection of high nut producing plants from the wild, performed by cooperators Jason Fischbach in Northern Wisconsin and Michael Demchic in Central Wisconsin. Collar (basal, underground stem) divisions were dug from selected plants and established in the greenhouse. These were cut back to force new growth from the juvenile, underground collar region (Fig. 2). Because bacteria and fungi grow so fast and are undesirable anyway, micropropagation requires sterilized culture vessels and medium, as well as a sterile transfer cabinet and sterilizable tools to handle the tissue (Fig. 3). In addition, the starting plant material must be isolated from contaminating microorganisms using dilute bleach or similar chemicals to surface sterilize the tissue. Successful isolates (stem pieces with no contaminates) developed new growth from lateral buds and when tall enough, the tips were cut and transferred to fresh medium (Fig. 4). The bases were also transferred, yielding new stems; repetition of this process resulted in rapid multiplication (Fig. 5). So far the process has worked well, but we have not yet optimized the multiplication phase as we considered it more important to test rooting, plant development and field performance first. However, optimization is important for the improvement of micropropagation efficiency and thus final per plant cost.

Once enough microcuttings were available, rooting was tested in the lab and found to be far more successful to that of conventional cuttings (Fig. 6). The quality of roots produced was excellent and new growth on the resulting rapidly-growing plantlets was readily acclimated to ambient conditions by gradual exposure to open air (Fig. 7). Subsequently, a larger set of cuttings were rooted, acclimated and established in the greenhouse. These were potted into 2 5/8 x 2 5/8 x 5 inch tree bands and after further growth were acclimated to outside conditions, initially under shade cloth (Fig. 8). These plants had excellent root mass and over time the buds on the lower stems began to swell (Fig. 9). This was significant as we wanted to maintain viable vegetative buds that would be buried with subsequent re-potting. The idea was to produce an underground vegetative axis for the establishment of a collar-like region similar to seedlings. This is important for the later production of new stems which may be critical for nut productivity over time. Therefore, a large part of the lower stems were buried when the plants were re-potted into 4 x 4 x 10 inch tree bands. The larger tree bands and heavy fertilization resulted in extremely uniform, rapidly growing plants (Figs. 10 and 11). Currently the plants are very vigorous and are quickly approaching a size suitable for field planting (Fig. 12). These plants will be used for field-establishment trials using fall plantings of dormant plants and spring plantings of actively growing plants.

The plants have started to branch and it is encouraging to see branching from buried buds (Fig. 13) for the reasons stated above. We have produced a sufficient number of plants to also start to address goal 1 listed above: in 2013 we will be begin to examine the effects of different levels of mulch and different levels of fertilizer on plant establishment and growth after planting.

We have started to work on the second stated goal: we now have several selections in vitro that should be ready for replicated performance trials in 2013 or 2014. We are certain that micropropagation will play a vital role in the future improvement of the American hazelnut for a new orchard crop for the Upper Midwest. Eventually other kinds of propagation using micropropagated plants as stock plants may prove to be less expensive and research aimed at such secondary propagation is planned.

The pictures below offer a clear view of the process and the results we have obtained so far. If there are any comments or questions regarding micropropagation of the American hazelnut, please contact Eric Zeldin by email at elzeldin@wisc.edu.

Fig. 2. Micropropagation starts with a high nut producing selection from the wild established in the greenhouse. Pruning of the stems removes apical dominance and new, more juvenile stems erupt from the underground collar region (right picture). Greenhouse stems are cleaner than those from the field (fewer bacteria and fungal spores) and juvenile tissue usually yields the bests results for micropropagation.

Fig. 3. A sterile transfer cabinet used to perform sterile transfers. Stems from hazelnuts cultures (left in picture) will be cut and placed on new media (center) using surgical steel quality sterilized tools (right).

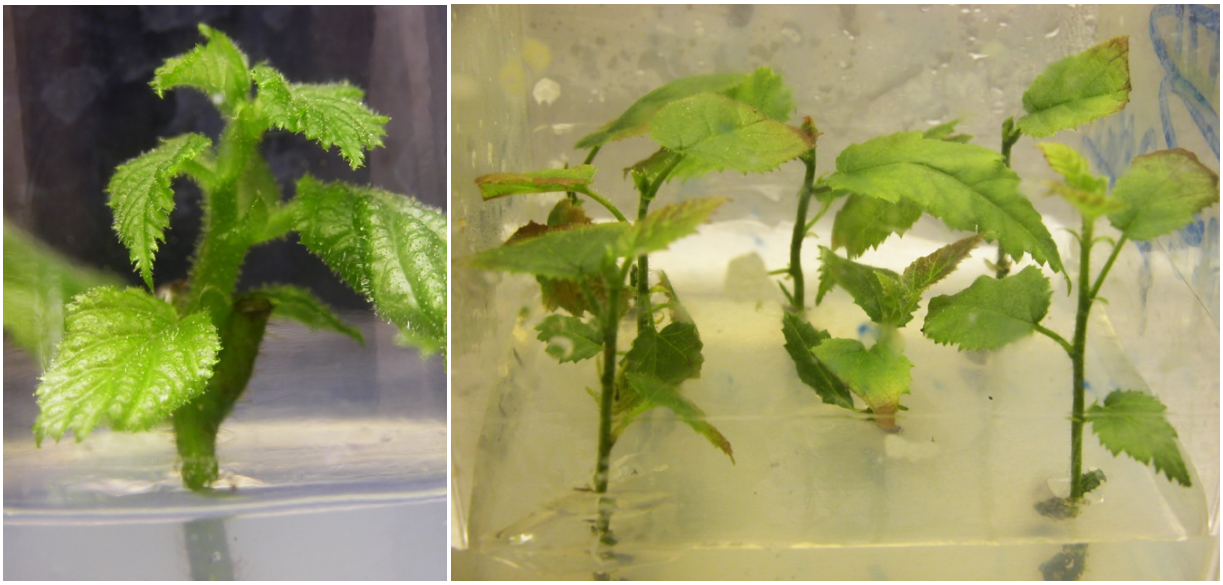

Fig. 4. A hazelnut isolate exhibiting new growth (left picture) and a group of new stems produced in vitro (right picture).

Fig. 5. Hazelnut cultures in the culture room. The first three trays (left picture) contain about 500 stems genetically identical to the source plant they were originally isolated from. A closer view (right picture) shows a culture with microstems ready for cutting and rooting. Further optimization of the multiplication phase will result in faster and cheaper multiplication.

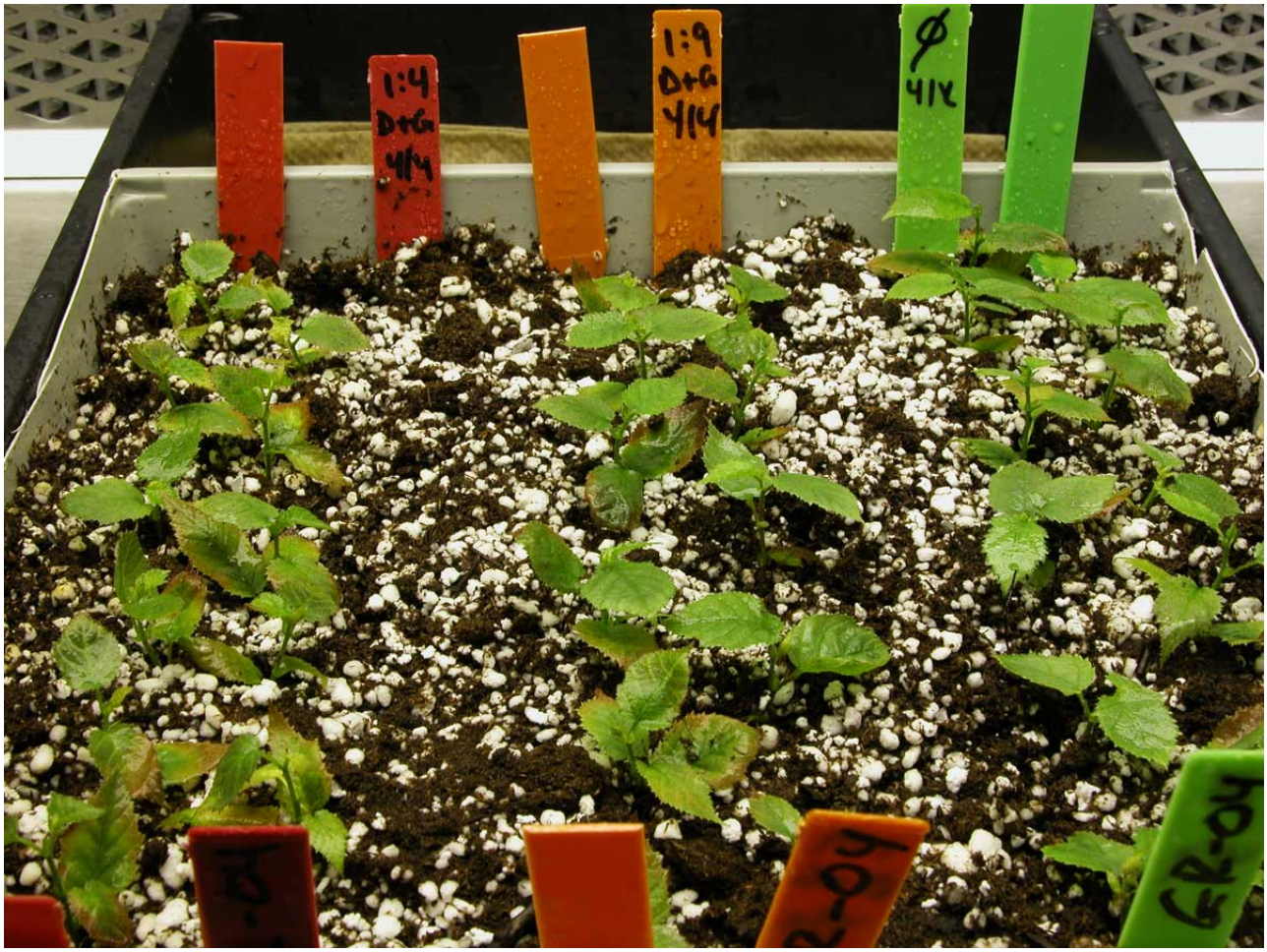

Fig. 6. Microcutting rooting trial. Two to three inch microcuttings were dipped in rooting hormone and placed in propagation mix (peat/perlite) in a 1020 tray covered with a moisture retaining plastic dome. Greater than 95% rooting has been achieved using microcuttings and rooting hormone treatments.

Fig. 7. Rooted microcutting with roots exposed (left picture) and young, greenhouse acclimated plants derived from microcuttings (right picture). Good quality rooting is essential for the tissue to acclimate from protected, in vitro culture to exposed ambient conditions.

Fig. 8. Greenhouse acclimated plantlets were repotted into 2 5/8 x 2 5/8 x 5 inch tree bands using commercial grower's mix and subsequently acclimated to outside conditions in a coldframe.

Fig. 9. A plant from Fig. 8 with the tree band removed to show root development (left picture) and a detail of the lower stem of another plant to show lateral bud swelling (right picture). These buds will be buried after re-potting.

Fig. 10. Re-potting of micropropagated plants to larger, 4 x 4 x 10 inch tree bands (left picture) and a top view of the re-potted plants showing a high degree of uniformity (right picture).

Fig. 11. A side view of the micropopagated plants in large tree bands after further growth.

Fig. 12. A single plant from the picture in Fig. 11, demonstrates the strong, vigorous growth achieved to date, with another month or so before dormancy sets in. These micropropagated American hazelnut plants will be tested both for fall 2012 (dormant) and spring 2013 (active growth) planting to determine which planting time yields the best field establishment.

Fig. 13. Many of the micropropagated plants are beginning to branch at this time (left picture) and many of these branches are coming from buried nodes (right picture). The development of new stems from buried nodes may be a critical factor for micropropagated American hazelnuts, as the re-establishment of a collar-like region may be required for continual production of new stems and nut producing capability.

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Setting A Yield Goal for Hazelnut Breeding in the Upper Midwest

Hazelnut Improvement Program

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Introduction

Bush-type hazelnuts have potential as a multi-use crop in the Upper Midwest providing both economic opportunities for growers and improved ecosystem services from the agricultural landscape. Private breeders in Minnesota and Wisconsin have been selling hybrid seedlings derived from interspecific crosses between European (*C. avellana*), Beaked (*C. cornuta*) and American hazelnut (*C. americana*). Survey work has identified more than 130 early-adopter growers with more than 66,000 genetically-unique plants. The current population of plants have demonstrated a wide range of yields, with an average yield that is unlikely to support a viable industry (Fischbach et al, 2011). However, it is possible some of the plants have the genetic potential to support a commercially-viable hazelnut industry in the Midwest. To find these plants, researchers with the Upper Midwest Hazelnut Development Initiative (UMHDI) have been working with the growers to screen on-farm plantings for high-performing plants for further evaluation in replicated germplasm trials.

Photo 1. Setting a yield goal for hazelnut breeding in the Upper Midwest will help determine whether yields from existing hybrid plants, such as shown here, are adequate for an economically viable industry.

As with all crops, germplasm improvement is a continuous process. To establish a new crop and concordant industry, the initial plant material must be a least sufficient to support economically-viable production. This Research Bulletin attempts to set a yield goal for ongoing plant improvement efforts in the Upper Midwest based on enterprise budgeting for the emerging industry. In other words, what is the minimum average annual in-shell yield sufficient to support commercially viable hazelnut production in the Upper Midwest? Furthermore, based on completed yield assessments, are there individual plants that have expressed the genetic capacity to meet this yield goal, such that mass selection efforts alone could provide viable cultivars?

Enterprise Budgeting

A fifteen year enterprise budget was developed to quantify cost-of-production on a per acre basis. Actual costs will vary considerably from farm-to-farm. In addition, there remain unanswered questions as to best management practices for hazelnut production such as pruning and fertilization. However, existing hazelnut systems are very similar to blueberry models with free-standing multi-stem shrubs in sod culture. For this budget, the following assumptions were made:

1. Plantings are arranged with a 15' row spacing and 6' plant spacing for a total plant density of 484 plants/ acre. The plants will fully fill their space by year 7. Plants cost $4 each. On lower fertility sites or with poor management, it may be necessary to increase plant density to compensate for slower growth.

2. Site preparation is done in the summer prior to planting with a burn-down herbicide application, followed by ripping and a finishing disk. Doing this work in strips can reduce tillage needs, but for this analysis the

entire field is ripped and disked.

3. The micropropagated plants are planted in the fall after September 15. Drip irrigation is installed and roughly 0.7 cubic feet of wood chip mulch is applied around each plant. Although plants currently available to growers are seedlings, it is likely the industry will move to micropropagules. Ongoing research is investigating the best time for planting these micropropagules.
4. A cover crop is seeded immediately after planting in the row middles. If strip site preparation is done to leave existing vegetation intact within the row middles this step could be avoided.
5. In the spring the year after planting a pre-emergent herbicide is applied. During each growing season, grass weeds within the rows are controlled with selective grass herbicides and perennial broadleaf weeds are controlled with shielded applications of glyphosate using a backpack sprayer.
6. Row-middles are mowed as necessary to control vegetation. Cropping the row-middles is also an option, but not included in this budget.
7. Water is applied as necessary through the drip irrigation system consisting of a y-filter, 3/4" polytube header line and 1/2" feeder lines with two emitters per plant. A household well is used to supply the water. No costs for the well, pump, or electricity are included in this budget.
8. Nitrogen is applied annually with strip-applied coated-urea at 15 lbs/ac in years 1-3, 30 lbs/ac in years 4 -6, and 60 lbs/ac annually starting in year 7. Potassium and phosphorus are adequate and no additional nutrients are applied. All new plantings should be soil tested prior to planting and potassium and phosphorus adjusted as necessary.
9. There is a 5% mortality rate in the year of planting and the plants are replaced in year 2.
10. Another .7 cubic feet of wood mulch is applied in the third growing season.
11. All equipment use is compensated on an hourly basis to cover all ownership and maintenance of the equipment.
12. The plants begin yielding in the 4th year and reach full production in year 7. Fourth, fifth, and sixth year nut yields are 25, 50, and 75% of the mature plant yields, respectively.
13. Fifty percent (50%) of all plants produce nuts in year 4, 75% in year 5, and in year 6 and each year after, 90% of the plants have nuts each year.
14. There is alternate year bearing starting in year 7 with every even year having average yields 20% less than in odd years.
15. The plants are harvested by hand and it takes 3 minutes per plant in year 4, 4 minutes per plant in years 5 and 6, and 5 minutes per plant starting in year 7. Mechanical harvest will likely be possible in the future with improvement in harvest technology and plant form.
16. Renewal pruning begins in year 8 with a goal of removing 1 or 2 of the oldest canes per plant per year. It takes 3 minutes per plant. Research on renewal pruning is just beginning and no formal recommendations have yet been developed.
17. Drying is done in wooden pallet crates with periodic turning of the nut clusters to promote rapid drying. Husking is done at a cost of $1/lb. The cost of the crates and labor for drying is included in the $1/lb husking cost.
18. General manual labor for planting, application of wood chips, renewal pruning, and harvest is hired at $12/hr (wage, taxes, insurance).
19. Custom tillage and field spraying (tractor, implement, operator) is hired at $100/hr.
20. Herbicide application is custom hired at $35/hr to cover the cost of operator, personal protective equipment, and sprayer depreciation. Row-middle mowing is custom hired at $35/hr to cover the cost of operator, mower fuel and maintenance, and mower depreciation.
21. No insecticides are applied, however, it is likely Japanese beetle, big bud mite, and nut weevils will require control via an integrated pest management strategy. EFB is managed with plant resistance.
22. The project is self-financed with no interest costs.
23. The final product sold in this model is in-shell nuts. There may be revenue opportunities from husk material, but no revenue is shown in this analysis.

Appendix 1 shows the input costs over a 15-year period for one acre of hazelnuts given the assumptions above.

Determining a Yield Goal

To determine a yield goal it is first necessary to identify a target economic return. In this analysis, returns for a blueberry planting or corn/soybean rotation are used. A commercial blueberry operation can be expected to provide a cumulative net return to management at year 15 of $20,000 with break even at year 7

(Julian et al, 2011). This is equivalent to an annual return to management of $1333/acre. A conventional corn and soybean rotation can be expected to provide an annual return to management of $187/acre (Johanns et al, 2012). If this return to management is compounded annually at 3%, at 15 years the cumulative return to management would be $3478/acre or $231.86/yr. This would include breaking even at year 12. The blueberry model will be referred to as the "High Return" model and corn/soy model as "Low Return" model.

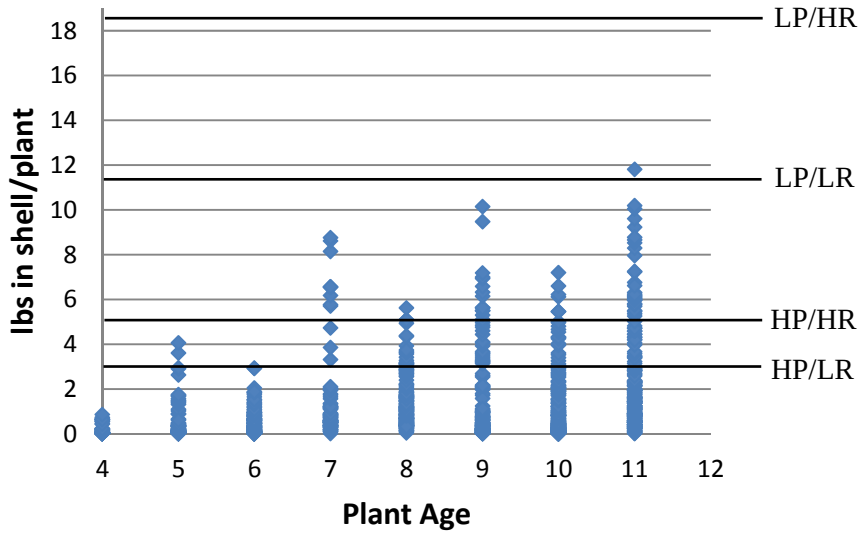

Figure 1. Minimum yield thresholds (horizontal lines) necessary for each of the four target economic scenarios in comparison to actual per plant yields from four sites in the Upper Midwest.. LP=Low Price ($1.50/lb); HP=High Price ($3.00/lb); LR=Low Return (corn/soy model); HR=High Return (blueberry model)

Determining a yield goal also requires identification of target prices for in-shell nuts. In this analysis, $1.50/lb will be used as the in-shell wholesale price based on USDA-ERS data ("Low Price"). It is likely a hazelnut industry in the Upper Midwest will organize grower-owned processing enterprises to add value to harvested nuts in order to pay growers more. For this analysis, $3.00/lb will be used for the grower processing price and termed: "High Price".

Using the costs-of-production shown in Appendix 1, the plant yields necessary to achieve the target returns for each of the two prices were calculated. To provide returns comparable to a corn/soy rotation ($3478/ac cumulative net income at year 15), minimum in-shell nut yields must be 3 lbs/plant at $3/lb and 11.25 lbs/plant at $1.50/lb. To provide returns comparable to blueberries ($20,000/ac cumulative net income at year 15), minimum in-shell nut yields must be 5 lbs/plant at $3.00/lb and 18.75 lbs/plant at $1.50/lb.

Assessing the Potential of Hybrid Hazelnuts

Current hazelnut breeding efforts of the UMHDI are focused on identification of select individuals from on-farm populations of inter-specific hybrids and from wild populations of American hazelnut (*Corylus americana*). Although selections have been made from the wild populations, the plants are currently being propagated for evaluation in field trials. As such, yield performance data won't be available for a number of years. However, there is considerable data available as to the performance of hybrid plants.

Dr. Lois Braun from the University of Minnesota has been measuring individual hybrid plant yields at four plantings in Minnesota and Wisconsin since 2004. Figure 1 shows the individual plant yields sorted by plant age at the time of yield measurement. In-shell yield was calculated by multiplying the kernel yield by three, assuming kernel yield is 1/3 total in-shell yield by weight. Yields are not adjusted by plant size. The figure contains 1098 individual yield measurements from 390 unique plants across the four sites. Figure 1 shows that within the current hybrid populations individual plants have produced yields above the target economic thresholds for both the Low and High Return scenarios if prices for in-shell nuts are $3.00/lb or more. Only one plant produced a yield sufficient for either target return with an in-shell price of $1.50/lb. This suggests that selections from these populations at least have the capacity to produce yields sufficient for a viable hazelnut industry in the Upper Midwest.

The yield capacity of a plant, however, is only one of the characteristics necessary for a viable cultivar. Consistent yields from year-to-year, and consistent yields across locations are equally important, as well as disease resistance and high kernel quality. Figure 2 shows the ten highest individual plant yields at each of the four sites sorted by plant age. The figure suggests that environment strongly influences yield, such that

only 1 of the 4 sites had plant yields in excess of the HP/HR threshold. Thus, in some locations existing hybrid genetics may not support viable hazelnut production. That said, it is unclear what the limiting factors (e.g. weed control, soil fertility, deer browse) are at Sites 1, 2 and 4. Overcoming these limitations through agronomic practices may improve the yields and economic viability.

To better understand the yield potential of the hybrid genetics, the top plants from each of the plantings have been propagated and are currently being evaluated in replicated germplasm trials at five locations. The trials were established in 2010 and performance data will be collected from each plant for at least 4 years.

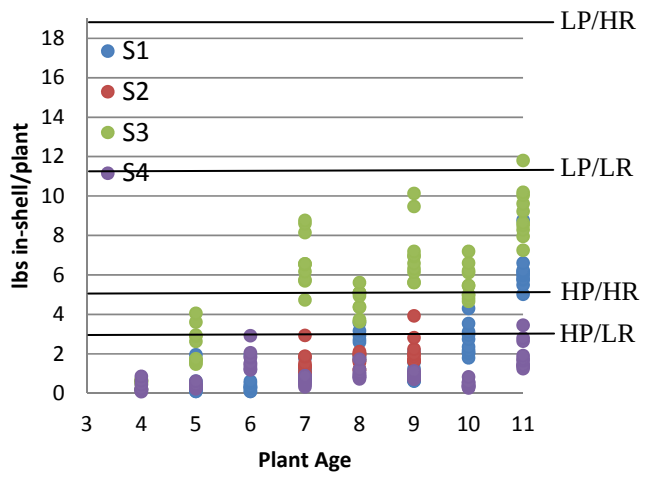

Figure 2. Minimum yield thresholds (horizontal lines) necessary for each of the four target economic scenarios in comparison to the ten highest individual plant yields sorted by plant age at each of four sites in the Upper Midwest. LP=Low Price ($1.50/lb); HP=High Price ($3.00/lb); LR=Low Return (corn/soy model); HR=High Return (blueberry model)

Conclusion

Hazelnut production in the Upper Midwest using bush-type plants has considerable economic potential, but will certainly require improved germplasm and, likely, business models that can pay growers $3.00/lb or more for in-shell nuts. When grown on higher fertility sites, the existing hybrid germplasm has demonstrated the potential to provide adequate yields. The next step is to identify individual plants that can sustain such yields from year-to-year and across a range of locations and that have durable resistance to eastern filbert blight. On lower quality sites, where current genetics may be economically marginal, proper management will be crucial to maximize yields. The germplasm trials underway in Minnesota and Wisconsin will provide a much more robust understanding of the suitability of the existing hybrid germplasm currently being grown by producers in the Upper Midwest.

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Upper Midwest Hazelnut Development Initiative

The Upper Midwest Hazelnut Development Initiative is a collaboration of researchers in Wisconsin and Minnesota working with early-adopter hazelnut growers to develop an Upper Midwest hazelnut industry.

Appendix 1. Enterprise Budgets for Bush-Type Hazelnuts in the Upper Midwest for Four Production Scenarios (Years 1-15)

Table 1. High Price/Low Return* Enterprise Budget - 3 lbs/plant

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Revenue	$ -	$ -	$ -	$ -	$1,088	$1,631	$2,936	$3,915	$3,132	$3,915	$3,132	$3,915	$3,132	$3,915	$3,132	$3,915
Expenses																
Land - Rented ($/ac/yr)	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Plants	$ -	$ 1,936	$ 97	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Drip Irrigation	$ -	$ 615	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer	$ 30	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15
Herbicide	$ -	$ 115	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ -
Wood chip mulch	$ -	$ 338	$ -	$ 338	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tillage	$ 300															
Weed control	$ 150	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210
Cover crop seeding	$ 100															
Mowing		$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280
General labor	$ -	$ 576	$ 264	$ 192	$ 48	$ 48	$ 48	$ 48	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348
Harvest Labor				$ -	$ 145	$ 290	$ 348	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435
Drying and Husking				$ -	$ 181	$ 544	$ 979	$ 979	$1,044	$1,305	$1,044	$1,305	$1,044	$1,305	$1,044	$1,305
Total Expenses	$ 660	$ 4,165	$ 946	$ 1,191	$ 959	$1,467	$1,960	$2,123	$2,412	$2,673	$2,412	$2,749	$2,412	$2,673	$2,412	$2,673
Net Income	$ (660)	$(4,165)	$ (946)	$(1,191)	$ 128	$ 165	$ 977	$1,792	$ 720	$1,242	$ 720	$1,166	$ 720	$1,242	$ 720	$1,242

* High Price = $3.00/lb for in-shell nuts, Low Return = $3,872 per acre cumulative net income at year 15

Table 2. High Price/High Return* Enterprise Budget - 5 lbs/plant

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Revenue	$ -	$ -	$ -	$ -	$1,813	$2,719	$4,894	$6,525	$5,220	$6,525	$5,220	$6,525	$5,220	$6,525	$5,220	$6,525
Expenses																
Land - Rented ($/ac/yr)	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Plants	$ -	$ 1,936	$ 97	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Drip Irrigation	$ -	$ 615	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer	$ 30	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15
Herbicide	$ -	$ 115	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ -
Wood chip mulch	$ -	$ 338	$ -	$ 338	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tillage	$ 300															
Weed control	$ 150	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210
Cover crop seeding	$ 100															
Mowing		$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280
General labor	$ -	$ 576	$ 264	$ 192	$ 48	$ 48	$ 48	$ 48	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348
Harvest Labor				$ -	$ 145	$ 290	$ 348	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435
Drying and Husking				$ -	$ 302	$ 906	$1,631	$1,631	$1,740	$2,175	$1,740	$2,175	$1,740	$2,175	$1,740	$2,175
Total Expenses	$ 660	$ 4,165	$ 946	$ 1,191	$1,080	$1,829	$2,612	$2,775	$3,108	$3,543	$3,108	$3,619	$3,108	$3,543	$3,108	$3,543
Net Income	$ (660)	$(4,165)	$ (946)	$(1,191)	$ 732	$ 890	$2,282	$3,750	$2,112	$2,982	$2,112	$2,906	$2,112	$2,982	$2,112	$2,982

* High Price = $3.00/lb for in-shell nuts, High Return = $20,991 per acre cumulative net income at year 15

Table 3. Low Price/Low Return* Enterprise Budget - 11.25 lbs/plant

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Revenue	$ -	$ -	$ -	$ -	$2,039	$3,059	$5,505	$7,341	$5,873	$7,341	$5,873	$7,341	$5,873	$7,341	$5,873	$7,341
Expenses																
Land - Rented ($/ac/yr)	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Plants	$ -	$ 1,936	$ 97	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Drip Irrigation	$ -	$ 615	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer	$ 30	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15
Herbicide	$ -	$ 115	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ -
Wood chip mulch	$ -	$ 338	$ -	$ 338	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tillage	$ 300															
Weed control	$ 150	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210
Cover crop seeding	$ 100															
Mowing		$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280
General labor	$ -	$ 576	$ 264	$ 192	$ 48	$ 48	$ 48	$ 48	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348
Harvest Labor				$ -	$ 145	$ 290	$ 348	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435
Drying and Husking				$ -	$ 680	$2,039	$3,670	$3,670	$3,915	$4,894	$3,915	$4,894	$3,915	$4,894	$3,915	$4,894
Total Expenses	$ 660	$ 4,165	$ 946	$ 1,191	$1,458	$2,962	$4,651	$4,814	$5,283	$6,262	$5,283	$6,338	$5,283	$6,262	$5,283	$6,262
Net Income	$ (660)	$(4,165)	$ (946)	$(1,191)	$ 581	$ 97	$ 854	$2,526	$ 590	$1,079	$ 590	$1,003	$ 590	$1,079	$ 590	$1,079

* Low Price = $1.50/lb for in-shell nuts, Low Return = $3,694 per acre cumulative net income at year 15

Table 4. Low Price/High Return* Enterprise Budget - 18.75 lbs/plant

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Revenue	$ -	$ -	$ -	$ -	$3,398	$5,098	$9,176	$ 12,234	$9,788	$ 12,234	$9,788	$ 12,234	$9,788	$ 12,234	$9,788	$ 12,234
Expenses																
Land - Rented ($/ac/yr)	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Plants	$ -	$ 1,936	$ 97	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Drip Irrigation	$ -	$ 615	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer	$ 30	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15	$ 15
Herbicide	$ -	$ 115	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ 76	$ -	$ -	$ -	$ -
Wood chip mulch	$ -	$ 338	$ -	$ 338	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tillage	$ 300															
Weed control	$ 150	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210
Cover crop seeding	$ 100															
Mowing		$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280	$ 280
General labor	$ -	$ 576	$ 264	$ 192	$ 48	$ 48	$ 48	$ 48	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348	$ 348
Harvest Labor				$ -	$ 145	$ 290	$ 348	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435	$ 435
Drying and Husking				$ -	$1,133	$3,398	$6,117	$ 6,117	$6,525	$ 8,156	$6,525	$ 8,156	$6,525	$ 8,156	$6,525	$ 8,156
Total Expenses	$ 660	$ 4,165	$ 946	$ 1,191	$1,911	$4,321	$7,098	$ 7,261	$7,893	$ 9,524	$7,893	$ 9,600	$7,893	$ 9,524	$7,893	$ 9,524
Net Income	$ (660)	$(4,165)	$ (946)	$(1,191)	$1,488	$ 776	$2,078	$ 4,973	$1,895	$ 2,710	$1,895	$ 2,634	$1,895	$ 2,710	$1,895	$ 2,710

* Low Price = $1.50/lb for in-shell nuts, High Return = $20,695 per acre cumulative net income at year 15

Hazelnut News

August 15, 2012 Volume 3

Upper Midwest Hazelnut Development Initiative

We're Growing

- Jason Fischbach, UW-Extension Agriculture Agent, Ashland and Bayfield County

Developing bush-type hazelnuts into a staple for woody agriculture in the Upper Midwest is a long term project. It will take time, resources, and more than anything else, people. We'll need the wisdom that grey hair brings, we'll need the resources and risk -taking of early adopters, and we'll need the idealism and vitality of students and young professionals.

Thus, it's exciting to see the Upper Midwest Hazelnut Development Initiative growing with three new student research collaborators. These students will be working on a range of projects over the next few years and we'll be sure to feature their research results at upcoming conferences and field days. Welcome to the project!

Brady Williams, Univ. of Wisconsin

Brady Williams is a Master's degree candidate in the Agroecology program at UW-Madison. He comes to agroecology with a background in the social sciences, having graduated with a BA in Social Studies from Harvard in 2006. At UW-Madison he is studying the development of mid-scale value-added perennial nut businesses. With the Midwest hazelnut industry in mind, he will conduct case studies of several value-added enterprises in order to learn lessons about the pros and cons of various organizational business structures. It is his hope that learning the stories of how other value-added businesses came about will help the development of value-added enterprises for the Upper Midwest hazelnut industry. Brady can be reached at: bgwilliams@wisc.edu

Molly Kreiser, Univ. of Minnesota

Molly Krieger is a graduate student starting this fall at UMN and will be working to develop protocols for micropropagation of hybrid hazelnuts. She will be working closely with Lois Braun and the entire Minnesota team. Her Bachelor's degree is in biochemistry and molecular biology from UW-Eau Claire. She also has experience studying plant physiological responses to elevated C02 levels. Molly can be reached at: mkreiser@umn.edu.

Kevin Wolz, Univ. of Illinois

Kevin Wolz is a student at the University of Illinois and a board member of the Restoration Agriculture Institute. He will be studying the agricultural and ecological characteristics of a woody perennial polyculture planting (including hazelnuts) in comparsion to a standard corn/soy rotation. Hazelnuts are envisioned as a component of diverse "woody agriculture" plantings providing food while protecting soil and water quality and enhancing agricultural biodiversity. To learn more about the project go to: nres.illinois.edu/News_Restoration_Ag_Project

Quick Notes:

- Hazelnut Propagation—A Step Closer
- Hazelnut Production Trials—Year 2
- To Tube or Not To Tube?
- Hazelnut Processing Update
- Grower Outreach—Field Days!
- Hazelnut Performance Trials
- Establishing Hazelnuts
- How Much Can I Make Growing Hazelnuts?

Upcoming Events:

Badgersett Hazelnut Field Day, Canton, MN	Aug. 18
WI Hazelnut Field Day, Eagle, WI	Aug. 25
IA Hazelnut Field Day, Fenton, IA	Sept. 15
MN Hazelnut Field Day, Lake City, MN	Oct. 6

Hazelnut Production Trials—Year 2

- Jason Fischbach, UW-Extension Agriculture Agent, Ashland and Bayfield County

In the spring of 2011, UW-Extension, in cooperation with Forest Agriculture Enterprises, established the Hazelnut Performance Trials at four locations in Wisconsin. The goals of the trials are to: 1) Develop enterprise budgets using real-world data, 2) Evaluate advanced selections of hazelnuts from the Forest Agricultural Enterprises breeding program, 3) Evaluate renewal pruning as a tool to manage yield, 4) Evaluate the use of tree tubes on hazelnut establishment, and 5) Provide demonstration sites for interested growers.

The trials were established in June 2011 at the Chequamegon Food Farm in Bayfield, Emancipation Acres in Stoughton, Hazel Valley Farm in Eagle, and the Spooner Agricultural Research Station in Spooner. Each planting consists of 350 full-sibling plants provided by Forest Agriculture Enterprises and 50 wild American hazelnuts sourced from the WI DNR. The plants are 6 feet apart and the rows are spaced 15 feet. At each site, mechanical tillage was used to create a weed free planting bed. The potted seedlings were transplanted in late-June and mulched. A Vine-Grow tree tube was installed over each plant and drip irrigation is being used to provide water. Weed control is being done through a combination of mowing, hand pulling, and herbicides.

Establishment Year Costs	Spooner	Bayfield	Eagle	Stoughton
Site preparation	$ 260	$ 150	$ 120	$ 450
Plants	$ 1,750	$ 1,750	$ 1,750	$ 1,750
Planting	$ 570	$ 595	$ 1,125	$ 480
Tree tubes (350 tubes @ $1.59ea)	$ 558	$ 558	$ 558	$ 558
Mulch	$ -	$ 200	$ 120	$ 240
Weeding	$ 425	$ 454	$ 120	$ 435
Drip irrigation	$ -	$ 648	$ 60	$ 648
Herbicides	$ 5	$ 15	$ 55	$ -
Total Cost	**$ 3,568**	**$ 4,370**	**$ 3,909**	**$ 4,561**
Cost Per Plant	**$ 8.92**	**$ 10.93**	**$ 9.77**	**$ 11.40**

Table 1. Establishment year (2011) costs for the Hazelnut Production Trials. Costs are based on $60/hr for tractor and implement and $15/hr for labor. Total cost does not include land or water costs.

As will be the case for establishing any given hazelnut planting, the exact management actions will vary based on soils, available equipment and materials, and weed pressure. Table 1 shows the input costs in the planting year for each of the four plantings. Like any perennial woody crop, there will be a significant up-front investment to establish hazelnuts. There are opportunities to reduce costs, certainly, but the most expensive scenario is having to re-plant. As the plants mature we will be collecting data on growth rates, precocity, and kernel yield. Stay tuned.

Bayfield Trial Planting. The Bayfield Production Trial was planted in June 2011 and is located on a well-drained sandy slope.

To Tube or Not to Tube?

- Jason Fischbach, UW-Extension Agriculture Agent, Ashland and Bayfield County

Installing a tree tube adds significant material and labor costs to a new hazelnut planting. Purchased in bulk for the Hazelnut Production Trials, the 30" tube and bamboo stake cost $1.59/plant and doubled the planting labor as it took at least as long to install the tree tube as it did to plant the hazelnut plant. However, the goal of the establishment year is establishment and the tree tube can be a valuable tool. Hazelnut seedlings such as shown in Photo 1 are pretty wimpy. Mice can sever the stem, wind can tatter the leaves, the weeds can quickly overtop the plant, and they are very easy to hit with the lawn mower or weed whip. By putting a tube over the plant, they are easy to see , they are protected from wind and mice, and they provide a barrier to protect the plants from rescue burn-down herbicides such as glyphosate (Round-up). As such, for beginning growers a tree tube can be a nice insurance policy.

Photo 1. A tree tube can be useful to protect vulnerable seedlings from wind, rodents and your mower, and promotes rapid growth, but the impact on survival, precocity, and long-term productivity is unknown. Picture at left: hazelnut seedling at planting. Picture at right: hazelnut nut seedling 13 months after planting.

What we don't know is how the tube affects the growth of the hazelnut plant and just when to remove the tube. To help answer these questions we established a tree-tube trial at Bayfield and Spooner in 2012. We installed the tubes immediately after planting in 2011 and left them on through the first winter. In the spring, we implemented three treatments: 1) Leave the tubes on all year, 2) Cut the tube in half to have a 15" tree tube, or 3) Remove the tree tube entirely. Photo 2 shows each of the three treatments. In the spring of 2013 we will collect data on # of stems, plant height, survival, and winter kill. Not unexpectedly, the plants are growing faster in the taller tree tubes and have grown out of the tubes (Photo 1) The growth is nice to see, but what we don't know is whether the growth will survive the winter or how the above ground growth is correlated with root and crown development. To answer these questions, we will be removing the full tubes at various times over the coming months: 1) In mid-August, 2) After dormancy, or 3) In the spring prior to budbreak. Stay tuned.

Photo 2. As part of the Hazelnut Production Trials, we're evaluating the effect of tree tubes on hazelnut survival, growth, and ultimately, productivity.

Establishing Hazelnuts

- Jason Fischbach, UW-Extension Agriculture Agent, Ashland and Bayfield County

Grower surveys conducted in 2008 and 2010 revealed that too many hazelnuts are dying during the establishment year. This mortality is due in part to the delicate condition of the hazelnut nursery stock currently available, but mostly to poor establishment practices by growers. In response, one of the goals of the UMHDI is to assist growers with establishment, particularly growers that are relatively new to agriculture.

The key to the establishment year is: 1) Starting with healthy plants that are ready to grow, and 2) Providing favorable conditions for hazelnut growth, which includes good soil tilth in the rooting zone, limited competition from weeds, and adequate soil moisture.

Currently, hazelnuts are primarily available as tubelings or 1-0 bareroot dormant plants. Tubelings are typically started from seed in the late-winter of the planting year and are shipped to the grower with a couple of fully expanded leaves during the summer. These plants are fairly delicate with very little room for error. The rooting medium must be kept moist during handling and after planting they must receive adequate water all summer long. Drip irrigation and mulch help considerably. Weed control is crucial as the plants are short with a very small root system. Pre-emergent or grass herbicides are typically used. I prefer a grow tube so I can use glyphosate without damaging the hazelnuts.

Bareroot dormant plants provide more room for error as they are planted in the spring when soil moisture is higher and there is little transplant shock because the plants are dormant at planting. Typically, the stems and root system are larger so they can tolerate higher weed pressure, but, like the tubelings, the plants do better with less competition. The plants are often too big for tubes, so weed control is done with grass herbicides and/or mowing.

Each grower has to develop a set of management practices specific to their situation as weed pressures, soils, access to equipment, and budgets vary from grower to grower. The following are some photos of various establishment methods with a brief discussion of the pros and cons of each.

Landscape fabric can be expensive but does provide long-term weed control. Wood chips can help keep the fabric in place, but soil staples are also needed. Watering can be a challenge as the fabric is typically not very permeable in the first year or so. Thus, drip irrigation is recommended. The landscape fabric is best used where perennial weeds are present, such as quackgrass, or when the grower knows they aren't likely to control weeds as well as they should. The primary drawback is the fabric doesn't decompose and you'll have to deal with scraps for many years.

Chopped straw or hay that hasn't yet gone to seed can be an inexpensive source of mulch. It is best applied to the rows prior to planting. It is an effective barrier for annual weeds in the first year, but does very little to stop perennial weeds. Thus, it's important to control rhizomatous grasses and broadleaves in the year prior to planting. As the mulch breaks down, weeds start to grow and can be controlled with herbicides or by hand pulling. Disturbing the mulch as little as possible will help it do its job as long as possible.

Establishing Hazelnuts, Cont.

Continued from page 4

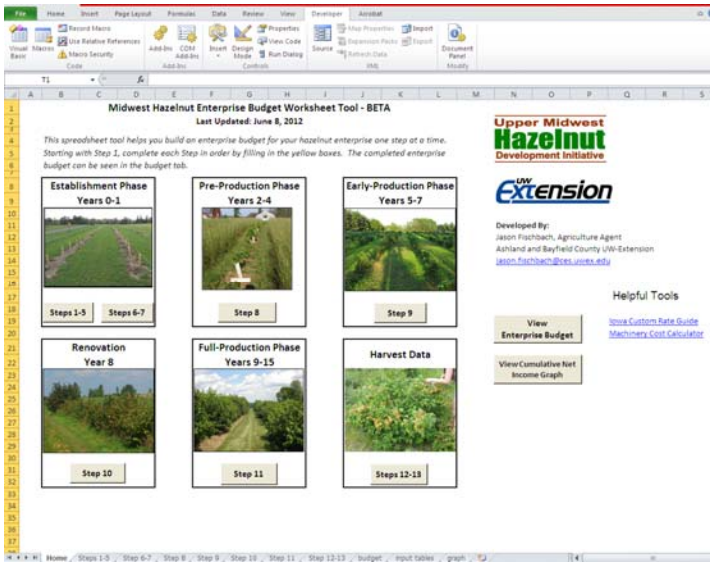
The combination of tree tubes, wood chips, drip irrigation, and glyphosate is currently my preferred method for tubelings or small potted plants. It's expensive up front, but it is perfect for those of us that are too busy to use other methods or didn't do a good job controlling perennial weeds prior to planting. To water I just flip a switch, to control weeds I use a backpack sprayer and apply glyphosate twice a year. I let the row-middles grow and do some mowing, if necessary. After the second year the plants are off to a good start and I can re-use the tree tubes and drip irrigation on a new planting.

This is the low-input method. You prepare a strip prior to planting with tillage and/or herbicides, put your plants in the ground, and rely on mowing to control weeds and rainfall to provide water. Even if the plants survive, they grow very very slowly. In the right situation the method can work, but if quackgrass or other aggressive perennial weeds are present or if the season is dry, additional weed control and watering will greatly improve establishment success and plant growth. Once established and a few feet tall the hazelnuts outcompete the grasses and forbs, the key is getting them to that point.

A New Tool To Help You Answer the Question: How Much Can I Make Growing Hazelnuts?

How much can I make growing hazelnuts? It's a common question, but there is no easy answer because there are so many variables. Each person has to answer that question him or herself. To help growers I have developed an Excel spreadsheet that allows you to create a customized enterprise budget. You can download the spreadsheet at www.midwesthazelnuts.org. It is fairly intuitive to use, but you do have to enable your macros to use all features of the program. Newer versions of Excel will prompt you to enable macros.

As you'll see in the tool, you have to enter a lot of information for which we don't yet have good data. For example, to make cash flow projections out fifteen years you have to project your average hazelnut yields for each year. You also have to estimate your harvesting and processing costs. As we generate such data from plantings across the region we'll be able to populate the tool with more and



The Midwest Hazelnut Enterprise Budget Worksheet Tool is available for free at www.midwesthazelnuts.org.

Hazelnut Performance Trials

Survey work to date has identified 130 hazelnut growers in the Upper Midwest growing nearly 67,000 hazelnut plants. Each of these plants is genetically unique originating from open-pollinated crosses. Within this population there are plants that are out-performing the rest and one of the major goals of the Upper Midwest Hazelnut Development Initiative is to find these plants, propagate them, and evaluate them compared to other high-performing plants across a range of environments.

Planting	# of Accessions*
St. Paul, MN	113
Lamberton, MN	83
Lake City, MN	89
Tomahawk, WI	73
Bayfield, WI	76

*An accession is an individual plant (genotype) that has been included in the trial. In most cases each accession was cloned through mound-layering with three or more replications at each site.

Thanks to the painstaking work of Dr. Lois Braun and her many assistants and collaborating growers, we have been able to establish replicated Hazelnut Performance Trials at five locations in the Upper Midwest (see below). This is a truly collaborative project with growers, as more than 90% of the plants are from grower plantings. Table 1 shows the number of accessions at each location. As the plantings mature, we will be collecting a range of performance data with the ultimate goal of identifying high-yielding, disease resistant plants for further evaluation in production trials across the region. Growers and the public will be able to track the performance of these plants via the HIP program at www.midwesthazelnuts.org starting this winter. Growers with promising plants that would like them evaluated in the Performance Trials are encouraged to contact Lois Braun at brau0259@umn.edu .

St. Paul, MN. This is the oldest performance trial with many of the shrubs starting to produce nuts.

Lamberton, MN. Located in SW Minnesota, this planting has struggled with deer browse, but is on the mend.

Tomahawk, WI. Our newest planting was planted in the fall of 2011 at the UW-Stevens Point Treehaven facility near Tomahawk.

Bayfield, WI. Established in 2010, this trial includes both hybrids from grower-owned plantings, but also accessions of wild-grown American hazelnut from NW Wisconsin.

Lake City, MN. The planting is located within Lake City, MN at Hazelnut Valley Farm.

Hazelnut Propagation—A Step Closer

- Eric Zeldin, Scientist, University of Wisconsin – Madison

Note: The full text of this article with photos can be found at www.midwesthazelnuts.org/research.html.

One of the major challenges in the development of the American hazelnut as a new crop is the difficulty in clonally propagating selected individuals. In most fruit and nut crops, selected individuals are grafted to produce new plants that are genetically identical. This is not feasible with the American hazelnut because grafting is difficult and the seedling rootstocks produce new stems that will bypass the desired individual anyway. Rooted cuttings can be utilized in many woody species, but trials with the American hazelnut have been variable, usually with a low percentage rooting and poor survival of those cuttings that do root.

Photo 1. Micropropagation starts with a high nut producing selection from the wild established in the greenhouse. Pruning of the stems removes apical dominance and new, more juvenile stems erupt from the underground collar region (right picture). Greenhouse stems are cleaner than those from the field (fewer bacteria and fungal spores) and juvenile tissue usually yields the bests results for micropropagation.

Micropropagation is the multiplication and recovery of whole plants using an in vitro, laboratory-based system. Micropropagation has been used to facilitate the propagation of many recalcitrant plants, and in the program of Professor Brent McCown at the Horticulture Department of the University of Wisconsin - Madison, we have been working with this type of woody plant biotechnology for over thirty years. As participants in the Upper Midwest Hazelnut Development Initiative, we are applying this expertise to the micropropagation of the American hazelnut.

Our specific goals in micropropagation research with the American hazelnut at this point in time are: 1) to perform clonal propagation to allow horticultural research (mulching, fertilizing, pruning, etc.) uncompromised by the genetic variation present with seedling plants, and 2) to facilitate the selection and development of elite individuals for enhanced yield and ease-of-culture through replicated clonal trials.

The process started with the selection of high nut producing plants from the wild, performed by cooperators Jason Fischbach in Northern Wisconsin and Michael Demchik in Central Wisconsin. Collar (basal, underground stem) divisions were dug from selected plants and established in the greenhouse. These were cut back to force new growth from the juvenile, underground collar region (Photo 1). Because bacteria and fungi grow so fast and are undesirable anyway, micropropagation requires sterilized culture vessels and medium, as well as a sterile transfer cabinet and sterilizable tools to handle the tissue. In addition, the starting plant material must be isolated from contaminating microorganisms using dilute bleach or similar chemicals to surface sterilize the tissue. Successful isolates (stem pieces with no contaminates) developed new growth from lateral buds and when tall enough, the tips were cut and transferred to fresh medium (Photo 2). The bases were also transferred, yielding new stems; repetition of this process

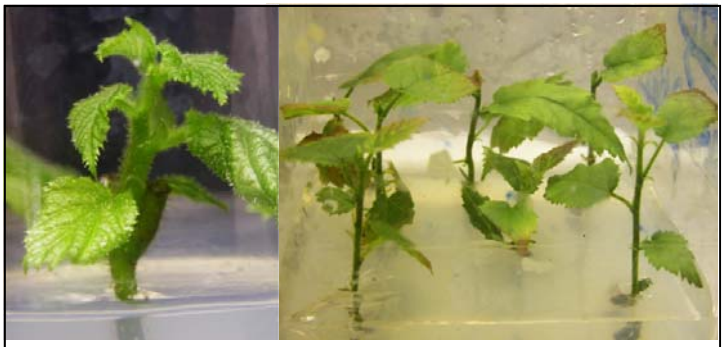


Photo 2. A hazelnut isolate exhibiting new growth (left picture) and a group of new stems produced in vitro (right picture).

Hazelnut Propagation, Cont.

Continued from page 7

resulted in rapid multiplication. So far the process has worked well, but we have not yet optimized the multiplication phase as we considered it more important to test rooting, plant development and field performance first. However, optimization is important for the improvement of micropropagation efficiency and thus final per plant cost.

Once enough microcuttings were available, rooting was tested in the lab and found to be far more successful to that of conventional cuttings. The quality of roots produced was excellent and new growth on the resulting rapidly-growing plantlets was readily acclimated to ambient conditions by gradual exposure to open air (Photo 3). Subsequently, a larger set of cuttings were rooted, acclimated and established in the greenhouse. These were potted into 2 5/8 x 2 5/8 x 5 inch tree bands and after further growth were acclimated to outside conditions, initially under shade cloth. These plants had excellent root mass and over time the buds on the lower stems began to swell. This was significant as we wanted to maintain viable vegetative buds that would be buried with subsequent re-potting. The idea was to produce an underground vegetative axis for the establishment of a collar-like region similar to seedlings. This is important for the later production of new stems which may be critical for nut productivity over time. Therefore, a large part of the lower stems were buried when the plants were re-potted into 4 x 4 x 10 inch tree bands. The larger tree bands and heavy fertilization resulted in extremely uniform, rapidly growing plants (Photo 4). Currently the plants are very vigorous and are quickly approaching a size suitable for field planting. These plants will be used for field-establishment trials using fall plantings of dormant plants and spring plantings of actively growing plants.

Photo 3. Rooted microcutting with roots exposed (left picture) and young, greenhouse acclimated plants derived from microcuttings (right picture). Good quality rooting is essential for the tissue to acclimate from protected, in vitro culture to exposed ambient conditions.

Photo 4. A side view of the micropopagated plants in 4 x 4 x 10 tree bands after further growth. These micropropagated American hazelnut plants will be tested both for fall 2012 (dormant) and spring 2013 (active growth) planting to determine which planting time yields the best field establishment.

Comments or questions regarding micropropagation of the American hazelnut? Please contact Eric Zeldin by email at elzeldin@wisc.edu.

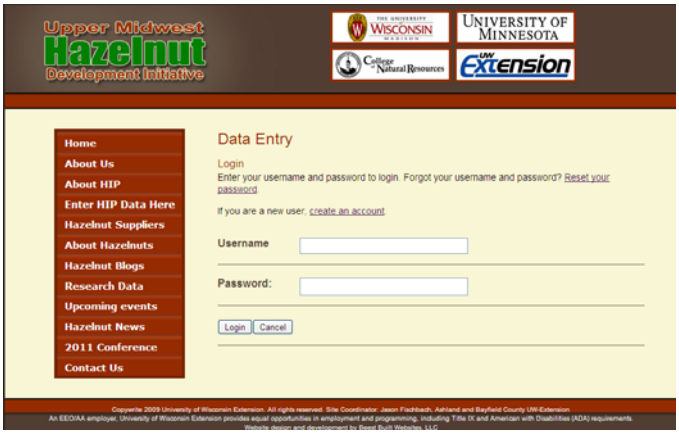
It's Harvest Time for the Hazelnut Improvement Program (HIP)

Participating in HIP is easy and fun. Pick your best plants, collect data at harvest, and enter the data in the HIP program. By next year, you'll be able to do it all from your smart phone.

Continued development of a hazelnut industry in the Upper Midwest will depend on a robust process of finding and/or breeding improved hazelnut plants. The goal of the Upper Midwest Hazelnut Development Initiative is to have a range of locally-adapted germplasm rather than one or two cultivars. To do this, we need the help of growers near and far. Growers have invested considerable resources and time into establishing hazelnut plants across the region. To make the most of this investment and to ensure our kids have improved hazelnuts to work with, we need to collect and record performance data on the best of these plants. To help growers, we launched the Hazelnut Improvement Program (HIP) in 2009. The program is pretty simple. You collect and enter data from your best plants and enter that data in the online program at www.midwesthazelnuts.org. This summer we will be sending out collection bags for your best plants. Harvest into the mesh bags, hang them somewhere away from varmints, and let them dry. At that point, you can send them to us and we'll husk and weigh the nuts, or you can do it yourself. To learn more about HIP go to www.midwesthazelnuts.org.

Screening Your Plants with HIP

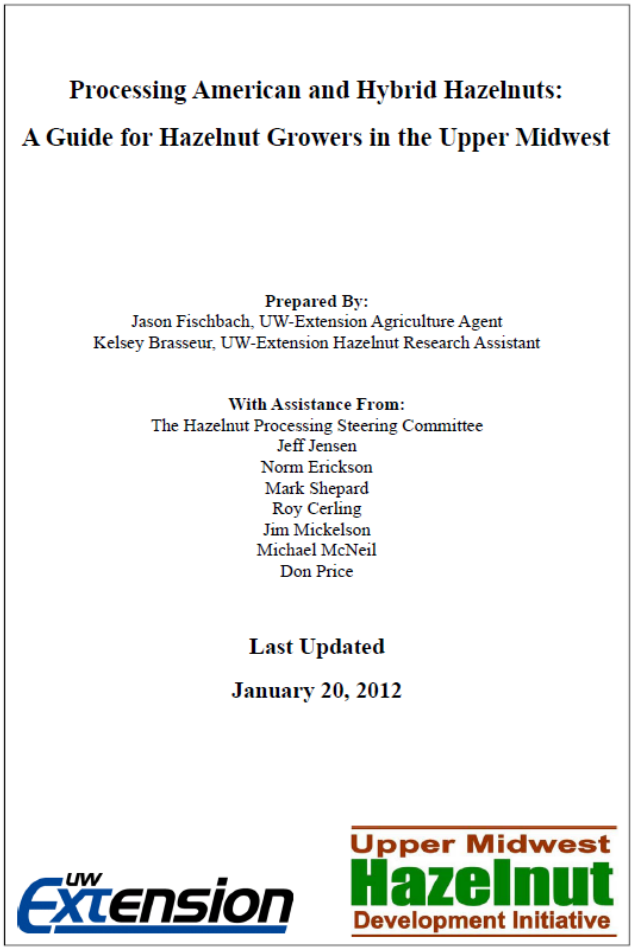
HIP is designed for growers to collect data about the best plants in a planting and enter the data online through the HIP page. To get started, visit www.midwesthazelnuts.org and download the program guide and watch the video. Once you have an account set up you can enter and organize your data and view the performance of plants entered by other growers. To date, there are 17 users of the website program with more than 200 plants listed. If you have questions about HIP please contact Jason Fischbach at jason.fischbach@ces.uwex.edu.



Hazelnut Processing Update

- Jason Fischbach, UW-Extension Agriculture Agent, Ashland and Bayfield County

2012 was an exciting year for hazelnut processing. The first edition of the UMHDI hazelnut processing guide was published and is available at www.midwesthazelnuts.org. The guide includes a description of what is involved in hazelnut processing and the various pieces of equipment currently available or still in development. The 2012 Upper Midwest Hazelnut Growers Conference featured demonstrations of a range of hazelnut husking, sorting, and cracking equipment. It was a great part of the conference and many thanks to Jeff Jensen for making it happen. The UW-Extension hazelnut husker will be demonstrated at the Wisconsin Field Day on August 25. The plans and parts list for the machine is also available for download at www.midwesthazelnuts.org.



Processing American and Hybrid Hazelnuts:

A Guide for Hazelnut Growers in the Upper Midwest

Prepared By:
Jason Fischbach, UW-Extension Agriculture Agent
Kelsey Brasseur, UW-Extension Hazelnut Research Assistant

With Assistance From:
The Hazelnut Processing Steering Committee
Jeff Jensen
Norm Erickson
Mark Shepard
Roy Cerling
Jim Mickelson
Michael McNeil
Don Price

Last Updated

January 20, 2012

UW Extension

Upper Midwest Hazelnut Development Initiative

Roy Cerling demonstrates the SuperSquirrel husker at the 2011 Wisconsin Hazelnut Field Day.

Dave Bohnhoff demonstrates his rotary hazelnut sorter at the 2012 Hazelnut Growers Conference.

Mark Shepard demonstrates the Terminutter™ hazelnut cracker at the 2011 WI Hazelnut Field Day.

Grower Outreach—Four Hazelnut Field Days!

Badgersett Research Corporation Annual Field Day

Saturday, August 18

Badgersett Research Farm

18606 Deer Road, Canton, MN, 55922

The BRC 21st Annual Field Day will be held on Saturday, August 18. See the Badgersett website (www.badgersett.com) for full details.

Wisconsin Hazelnut Field Day

Saturday, August 25, 1-3PM

Hazel Valley Farm

S70W34138 Township Rd. X, Eagle, WI 53119

The Annual Wisconsin Hazelnut Field Day will be held in Eagle, WI this year at Hazel Valley Farm, operated by Jeannie and Dean Herold. The field day is intended as an introduction to hazelnuts with a focus on establishment, management, and harvest. Attendees will learn about hazelnuts for food, feed, and fuel, establishing and managing hazelnuts, the Hazelnut Improvement Program, and the Hazelnut Production Trials. The field day is free and open to the public. More information can be found at www.midwesthazelnuts.org.

Iowa Hazelnut Foundation Field Day

Saturday, Sept. 15, 11AM-3PM

Hazel Acres

3503 40th Ave., Fenton, IA

Hazel Acres and the Iowa Nut Growers Association are hosting this two-for-one opportunity. Tour area hazelnut and aronia plantings. The field day starts at 11AM with a potluck lunch at 12:15 followed by afternoon tours. For more information contact Jeff Jensen at jeff@jenagres.com.

Minnesota Hazelnut Foundation Field Day

Saturday, Oct. 6, 10AM to 4PM

Hazelnut Valley Farm

1186 W. Lakewood Avenue, Lake City, MN

The annual Minnesota Hazelnut Foundation Field Day will be held in Lake City at Hazelnut Valley Farm, operated by Norm and Mary Erickson. The field day is free and open to the public. The day will start with the MN Hazelnut Foundation annual meeting at 9:00AM, presentations from hazelnut researchers from 10AM-Noon, lunch at Noon, and tours all afternoon. This is a great annual field day with lots of learning opportunities. For more information contact Jeff Jensen at jeff@jenagres.com.

Stay Connected Through the UMHDI Website (www.midwesthazelnuts.org)

One of the goals of the Upper Midwest Hazelnut Development Initiative is to keep growers informed and involved in our work with hazelnuts. We hope hazelnuts will continue to be a grassroots effort that can bring meaningful improvement to the economics and ecology of agriculture. Our website (midwesthazelnuts.org) is the best means for you to keep informed and keep connected. You can also sign up for the hazelnut mailing list to receive periodic email updates. The website also provides links to hazelnut plant suppliers and may soon provide a marketplace for the buying and selling of hazelnuts.

As the research work of the UMHDI progresses, we will provide periodic updates via Research Reports such as this. All of the Research Bulletins, conference presentations, and other publications can be found at www.midwesthazelnuts.org.

MICROPROPAGATION POTENTIAL FOR THE AMERICAN HAZELNUT

Eric Zeldin, Scientist, University of Wisconsin – Madison

August 14th, 2012

One of the major challenges in the development of the American hazelnut as a new crop is the difficulty in clonally propagating selected individuals. In most fruit and nut crops, selected individuals are grafted to produce new plants that are genetically identical. This is not feasible with the American hazelnut because grafting is difficult and the seedling rootstocks produce new stems that will bypass the desired individual anyway. Rooted cuttings can be utilized in many woody species, but trials with the American hazelnut have been variable, usually with a low percentage rooting and poor survival of those cuttings that do root (Fig. 1).

Micropropagation is the multiplication and recovery of whole plants using an in vitro, laboratory-based system. Micropropagation has been used to facilitate the propagation of many recalcitrant plants, and in the program of Professor Brent McCown at the Horticulture Department of the University of Wisconsin - Madison, we have been working with this type of woody plant biotechnology for over thirty years. As participants in the Upper Midwest Hazelnut Development Initiative, we are applying this expertise to the micropropagation of the American hazelnut.

Fig. 1. One rooting test with American hazelnut that yielded only 10% satisfactory rooting.

Why do micropropagation? There are many advantages and very few drawbacks to micropropagation. With micropropagation we can:

- Propagate anytime, independent of weather, climate and location.
- Propagate much faster, achieving exponential increase once cultures are established.
- Propagate free of pests and diseases.
- Produce extremely uniform plants.
- Produce plants that grow and establish faster than those obtained from conventional cuttings.

However, micropropagation is not always successful and it can be quite expensive due to the costs of specialized equipment, supplies and personnel required. Research is necessary to overcome these difficulties.

Our specific goals in micropropagation research with the American hazelnut at this point in time are: 1) to perform clonal propagation to allow horticultural research (mulching, fertilizing, pruning, etc.) uncompromised by the genetic variation present with seedling plants, and 2) to facilitate the selection and development of elite individuals for enhanced yield and ease-of-culture through replicated clonal trials. This article describes in text and pictures our initial efforts towards micropropagating the American hazelnut, from selected parent plants to hundreds of genetically identical, field-ready plants.

Upper Midwest Hazelnut Development Initiative

The Upper Midwest Hazelnut Development Initiative is a collaboration of researchers in Wisconsin and Minnesota working with early-adopter hazelnut growers to develop the fledgling Upper Midwest hazelnut industry.

Minnesota Hazelnut Foundation · College of Natural Resources · UW Extension · The University of Wisconsin Madison · Rural Advantage · Northland College · University of Minnesota

For comments or questions relating to the content of this newsletter please contact Jason Fischbach at 715-373-6104 ext 5 or jason.fischbach@ces.uwex.edu. Suggestions for future newsletter topics are also welcomed.

Locally Grown: Making it Safe
Evaluation (June 2012)

We have developed a brief survey to help us evaluate the booklet, *Locally Grown: Making it Safe*. After reviewing the booklet, please complete the survey online at:

http://www.surveymonkey.com/s/LocallyGrownBooklet

Or, if you prefer, you may complete and return the survey below to the Division of Food Safety, Wisconsin Department of Ag, Trade and Consumer Protection, 2811 Agriculture Drive, PO Box 8911, Madison, Wisconsin 53708-8911.

1. In general, how useful do you believe the booklet, *Locally Grown: Making it Safe*, will be for evaluating safety practices on farms that sell produce locally? (Check the box that best describes the level of usefulness.)

Very useful	10 (62.5%)
Somewhat useful	6 (37.5%)
Not very useful	0
Useless	0
No opinion	0
Total Responses	16 (100%)

2. The booklet, *Locally Grown: Making it Safe*, includes information about food safety growing practices. Please check the response that best describes your level of agreement with each statement below about the booklet.

The booklet was easy to read.	Strongly Disagree 0	Disagree 0	No Opinion 0	Agree 11 (68.8%)	Strongly Agree 5(31.3%)
I am likely to use the information in the booklet to assess food safety growing practices on a farm.	Strongly Disagree 0	Disagree 0	No Opinion 3 (18.8%)	Agree 8 (50%)	Strongly Agree 5(31.3%)
The pictures in the booklet were helpful for illustrating safe growing practices.	Strongly Disagree 1 (6.3%)	Disagree 0	No Opinion 0	Agree 7 (43.8%)	Strongly Agree 8 (50%)

Survey continues on back

3. The booklet includes a checklist for assessing food safety growing practices on a farm. How likely are you to use this checklist to evaluate the safety of the produce you grow or purchase? (Check the box below that best represents your opinion.)

Very likely	1 (6.3%)
Somewhat likely	1 (6.3%)
Somewhat unlikely	3 (18.8%)
Extremely unlikely	4 (25.0%)
No opinion	7 (43.8%)

4. Which of the following best describes you: (You may check more than one response.)

I manage a farmer's market	15 (93.8%)
I purchase produce from farmers for my own personal use	5 (31.3%)
I grow produce for sale to the public	8 (50.0%)
I purchase produce from farmers for use in a business	1 (6.3%)
I grow produce for sale to businesses	2 (12.5%)
None of the above	0 (0.0%)

5. If you have any additional comments about the booklet or the checklist at the end of the booklet, please share them here:

- I think the checklist at the end of the booklet is very useful and very organized, which makes it easy to use. The booklet itself has very good information.

- I think this booklet is great. Please send me any information regarding managing a farmer's market

- The pictures appear to be from California. They are not relevant to Wisconsin. I like the point you made that "local" does not guarantee that food is safe. It challenges the false mantra on that point being advanced by "locavores" You should also address how insurance and potential liability are related to following or not following these practices. (*Analyst note: The pictures in the booklet are from Wisconsin*.)

- The executive board felt it was geared more toward growers who hire workers and have like an apple or vegetable shed than just the seasonal farmer's marketer.

- Good job! :)

Locally Grown: Making it Safe
Evaluation

We have developed a brief survey to help us evaluate the booklet, *Locally Grown: Making it Safe*. After reviewing the booklet, please complete the survey online at:

http://www.surveymonkey.com/s/LocallyGrownBooklet

Or, if you prefer, you may complete and return the survey below to the Division of Food Safety, Wisconsin Department of Ag, Trade and Consumer Protection, 2811 Agriculture Drive, PO Box 8911, Madison, Wisconsin 53708-8911.

1. In general, how useful do you believe the booklet, *Locally Grown: Making it Safe*, will be for evaluating safety practices on farms that sell produce locally? (Check the box that best describes the level of usefulness.)

Very useful	10 (62.5%)
Somewhat useful	6 (37.5%)
Not very useful	0
Useless	0
No opinion	0
Total Responses	16 (100%)

2. The booklet, *Locally Grown: Making it Safe*, includes information about food safety growing practices. Please check the response that best describes your level of agreement with each statement below about the booklet.

The booklet was easy to read.	Strongly Disagree 0	Disagree 0	No Opinion 0	Agree 11 (68.8%)	Strongly Agree 5(31.3%)
I am likely to use the information in the booklet to assess food safety growing practices on a farm.	Strongly Disagree 0	Disagree 0	No Opinion 3 (18.8%)	Agree 8 (50%)	Strongly Agree 5(31.3%)
The pictures in the booklet were helpful for illustrating safe growing practices.	Strongly Disagree 1 (6.3%)	Disagree 0	No Opinion 0	Agree 7 (43.8%)	Strongly Agree 8 (50%)

Survey continues on back

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Very likely	1 (6.3%)
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