

FY 2011 Specialty Crop Block Grant Program

Maine Department of Agriculture, Conservation and Forestry

Final Report

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Submitted by:

Contact: Jessica Nixon, Director
Market Development
Division of Agricultural Resource Development
Bureau of Agriculture, Food and Rural Resources
Maine Department of Agriculture, Conservation and Forestry

Address: 28 State House Station
Augusta, ME 04333

Phone: (207)287-3494

Email: jessica.l.nixon@maine.gov

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Project 1: “Cost-share Arrangements for Funding GAP/GHP Audits/Visits for Maine Specialty Crop Growers-2012”

Final Report –Previously Accepted

Project Summary

“Cost-share Arrangements for Funding GAP/GHP Audits/Visits for Maine Specialty Crop Growers for 2012” offered all Maine Specialty Crop Growers a reimbursement of up to and including \$300.00 of the charges by the auditors for successful GAP/GHP certification for 2012. Growers paid for the audit when it was performed. They submitted the application the auditor gave them to AgMatters LLC and we confirmed that it was a successful audit and its actual cost with the auditors and then sent each auditee a check for up to \$300. This grant began January 1 and ended December 28 of 2012. The GAP/GHP certifications eligible for reimbursement with this grant included: Farm Review; Field Harvesting and Field Packing Activities; House Packing Facility; and Storage and Transportation.

Background for Purpose of Project--

The purpose of this grant was to aid Maine Specialty Crop farmers to maintain or increase their markets and provide the safest food they can by giving them up to \$300. back on their investment of a GAP/GHP audit. GAP

certification is not mandated by the government, it is mandated by the Specialty Crop market. It is highly encouraged by specialty crop consumers. Many growers were on the fence about whether their investment in an audit would pay off. This audit represents a risk taken by growers. This funding encouraged 15% more growers to become certified in 2012 than were certified in 2011.

Importance and Timeliness of Project—This grant was offered at a critical time in implementation of Food Safety demands by markets in Maine. The approximate cost for most small growers to become GAP certified in Maine is about \$1000. per farm. This is a lot of money to invest to “try” out a market. This grant allowed growers who were thinking about growing their markets to do so at a reduced cost of investment.

This grant built on the RFP# 20100362 “Cost-share Arrangements for Funding GAP/GHP Audits/Visits for Maine Specialty Crop Growers”, which was funded for the year 2011 only, but which reimbursed over 103 growers for successful audits.

Year	#Audits	Reimbursement Dollars
2009 actual	83	N/A
2010 actual	102	N/A
2011 estimate (2011 grant)	101	\$30,300.00
2012 projection (2012 grant)	116	
2012 actual	120	\$34,800.00

Project Approach

Summary of Activities Performed--The process for growers to receive that reimbursement was simple. Growers paid the auditors for their audit immediately upon conclusion of the audit. The auditors distributed applications for this reimbursement at each audit. (The application was also available at specialty crop meetings, on line, by phone, mail or email) Growers ensure that AgMatters LLC receives

the completed reimbursement application. AgMatters LLC coordinated with the auditors to double check that the growers were certified and the actual cost of the audit. AgMatters LLC also monitored the list of growers that were audited to make sure they were aware of the reimbursement grant. The grower received a reimbursement check for GAP/GHP auditor costs of up to and including \$300.00 for 2012.

Significant Results/Developments—The most significant result was that we ran out of money! This meant that more growers were certified than we anticipated. We believe that the availability of the funding encouraged some growers to become certified for markets that they had not, as of yet, been able to sell to.

Role of Partners— The role of the partners in this grant was that of information sharing to make growers aware of the existence of the grant. The Maine GAP/GHP Auditors were exceptional in their willingness to cooperate with AgMatters LLC. They supplied bi-weekly reports of completed audits and costs. They gave out reimbursement applications at every audit they performed. The Maine Pomological Society, the Maine Vegetable and Small Fruit Growers Association, and Maine Sustainable Agriculture all invited AgMatters to speak to their groups or to put information in their newsletters about the grant.

Goals & Outcomes Achieved

Results--We hoped that 15% more (116) Maine farms than the number certified in 2011 (103) would become GAP/GHP certified and participate in wholesale distribution beyond farm stands and CSAs because of this funding opportunity. In actuality, 121 GAP/GHP Audits were performed for Specialty Crop Growers in Maine in 2012. This equated to an increase of about 20%, which surpassed our goal.

117 Maine farms asked for reimbursement from this grant. Four growers who became certified did not seek reimbursement from this grant. The last farm to ask for reimbursement received partial reimbursement (instead of \$280.00, as we only had \$184. left in the account.)

Another significant result of this grant was that 26 growers sought GAP/GHP certification for the first time this year.

We are aware that several farms that were certified in 2011 decided to wait until the spring of 2013 to renew their certifications, as their certifications were valid for their growing season in 2012.

We are aware that several markets required their growers to seek different certification than GAP/GHP, and that that also affected the total GAP/GHP audit count.

We are aware of one crop failure in 2012 that resulted in no need for an audit this year.

In summary, there were five more audits performed in 2012 than we predicted. More than twenty-two percent of the totals of 121 audits were for growers new to this certification.

There are no funds remaining in this grant. The last reimbursement was for \$184. instead of the \$280.00 that the grower was eligible for.

We distributed \$34,800.00 in reimbursement funds back to Maine Specialty Crop Growers in 2012. 107 of these reimbursements were for the maximum allowed by this grant, \$300.00. This means that 88% of these audits cost in excess of \$300. each. (Several were in the thousands of dollars range) The least expensive audit cost was one for \$276.00.

Beneficiaries

The beneficiaries of this grant were the Specialty Crop growers who were able to afford to take a risk and be audited, knowing that even though their market would not reimburse them for this, that this grant would provide them some reimbursement.

This grant made this the year for growers to go for their certification. Many decided to do this because their market demanded it and they wanted to see if that market was worth the investment in costs necessary to be certified. Next year, it will be interesting to note how many growers maintain this certification without this financial impetus.

Although this grant was for 2012, we felt it was applicable and interesting to be able to point out the similarities and differences between 2011 and 2012 audit reimbursement requests, since both programs were funded through ME Specialty Crop Grant money:

Maine GAP/GHP Audits in 2011 and 2012

FARM NAME	2011	2012
Aaron Turner Farms	\$0.00	\$300.00
Anderson Farms / Pumpkin World Inc.	\$300.00	\$300.00
Ararat Farms LLC		\$300.00
Atcheson Farms	\$300.00	\$300.00
Ayer Potato Co.	\$300.00	\$300.00
B.D. Grass & Sons	\$300.00	\$300.00
Backyard Farms, LLC	\$300.00	\$300.00
Bell Bros.	\$300.00	\$300.00
Bell Farms Inc.	\$300.00	
Bellevue Farm Inc	\$0.00	\$184.00
Beth's Farm Market	\$300.00	\$300.00
Bouchard Farms	\$300.00	\$300.00
Boutilier Farms	\$0.00	\$300.00
Brackett Orchards	\$300.00	
Brandon Rooper	\$300.00	
Brent Edgecomb Farms	\$280.00	\$300.00
Brent Flewelling	\$300.00	\$280.00
Buck Farms	\$300.00	\$300.00
Campbell Family Farms	\$300.00	\$300.00
Cavendish Farms Operations Inc.	\$300.00	\$300.00
Clark Farms	\$300.00	
Clayton Roy	\$300.00	\$300.00
Cole G. Bridges Wild Blueberry Co.	\$300.00	\$300.00
County Fair Farm	\$300.00	
County Super Spuds Inc.	\$300.00	\$300.00
Crane Bros. Farms-Flood Zone Farm	\$300.00	\$300.00
Crestholm Farm	\$0.00	\$300.00

Cross Rd Farm	\$0.00	\$300.00
Dana Morrell Farms	\$300.00	\$280.00
Dan-a-Dew Farm	\$0.00	\$300.00
DC Farms Inc	\$13.00	\$300.00
Donald Fitzpatrick	\$300.00	\$300.00
Double G Farms Inc	\$300.00	\$300.00
Doug & Jeff Blackstone	\$0.00	\$300.00
Duane & Gerald Theriault Farm	\$0.00	\$300.00
Duane Grass Farms	\$300.00	\$300.00
Dunlap Vegetable Farm	\$300.00	
Edgecomb Farms LLC	\$300.00	\$300.00
Emerald Valley Ranches LLC/	\$0.00	\$300.00
Farmer Kev's Organic	\$0.00	\$280.00
Five Fields Farm	\$300.00	\$300.00
Flewelling Farms	\$300.00	\$300.00
Foster Farms Realty Trust	\$300.00	\$300.00
Francesca Farms	\$300.00	
G&M Farms, Inc.	\$300.00	\$300.00
Gardiner Farms	\$0.00	\$300.00
GB&D Farms	\$0.00	\$300.00
Gerald McAvoy		audited
Good Farms Inc.	\$300.00	\$300.00
Gough Farms	\$280.00	\$300.00
Grants	\$300.00	\$300.00
Gregory Schools Farms	\$300.00	\$300.00
Guerrete Sales	\$300.00	
Guerrette Farms Corp	\$300.00	audited
Hallett Farms	\$300.00	\$280.00
Homewood Farm	\$300.00	\$300.00
Howard Farms	\$300.00	\$300.00
Ireland Farms	\$300.00	\$300.00
Irving & Marr Farms	\$300.00	\$300.00
Irving Farms	\$300.00	\$300.00
Isacc		audited
Isaac Skillings Farm	\$300.00	\$300.00
James P. Cote	\$300.00	\$300.00
Jay Boyd Farms		\$300.00
Jeffrey & Owen Smith Inc.	\$300.00	\$276.00
Jillson's Farm & Sugarhouse	\$300.00	
Joan & Brad's Berry Farm	\$0.00	\$300.00
John Roy	\$0.00	\$300.00
Kingsbury Family Farm LLC	\$300.00	\$300.00
Kyle Blackstone & Sons	\$300.00	\$300.00

LaBrie Farms LLC	\$300.00	\$300.00
Lagerstrom Farms	\$300.00	\$300.00
Lajoie Farms	\$0.00	\$300.00
LaJoie Growers LLC	\$300.00	\$300.00
Lakeside Family Farm	\$300.00	\$300.00
Landeen Farms	\$300.00	\$300.00
Leavitt Farms LLC	\$300.00	\$300.00
Lemieux's Orchards	\$300.00	\$300.00
Lewis Family Partnership	\$300.00	\$300.00
Linda's Wild Maine Blueberries	\$300.00	\$300.00
Littleton Potato Growers	\$300.00	\$300.00
Madore Farms	\$300.00	\$300.00
Maine Apple Company	\$300.00	\$300.00
Maine Sweet and Wild	\$300.00	\$300.00
Mainly Hydroponics Olivia's Garden	\$0.00	\$300.00
Marquis Farms	\$0.00	\$300.00
McCain Foods USA Inc.	\$300.00	\$300.00
McDougal Orchards LLC	\$300.00	
Michael Fitzpatrick	\$300.00	\$300.00
Michael Hagan	\$0.00	audited
Moir Farms LLC	\$300.00	\$300.00
Moody Farm Cranberries	\$300.00	\$300.00
Moorebrook Farm	\$300.00	\$300.00
Murray, Dan, & Bill Blackstone	\$300.00	\$300.00
Nason Farms		\$300.00
Naturally Potatoes	\$0.00	\$300.00
Nature's Circle Farm	\$0.00	\$300.00
Nelson Chapman Farms LLC	\$300.00	\$300.00
New England Diversified Ind. Inc.	\$300.00	\$300.00
North Star Orchards	\$300.00	\$300.00
Orcutt Farm	\$300.00	\$300.00
Osborne Family Farm Inc	\$0.00	\$300.00
Page Farms	\$280.00	\$280.00
Parent Brothers	\$300.00	\$300.00
Paul St. Pierre Jr.	\$300.00	\$300.00
Pelletier Farms, Inc.	\$300.00	\$300.00
Pineland Farms Inc dba Gillespie Farms	\$300.00	\$300.00
Porter Farms LLC	\$13.00	\$300.00
Queen Bee / New Elm Farm	\$0.00	\$300.00
R. Belanger & Sons	\$300.00	\$300.00
Randall Orchards	\$300.00	\$300.00
Robert Hallett		

Ross Ridge Farms	\$300.00	\$300.00
Rowe Orchards	\$0.00	\$300.00
Sandy River Farm	\$0.00	\$300.00
Scott Ayotte	\$300.00	\$300.00
Scott Martin		\$300.00
Seaman's Farm Inc	\$300.00	\$280.00
Smith's Farm Inc.	\$300.00	
Snow Road Farms	\$300.00	\$300.00
Spear Farms Inc.	\$300.00	\$300.00
Steve W. Bubar	\$300.00	\$280.00
Steven & David Beaulieu	\$300.00	\$300.00
Stuart Sutherland	\$300.00	\$280.00
Sugarloaf View Farm	\$300.00	
The Apple Farm	\$300.00	\$300.00
Thomas Farms	\$300.00	\$300.00
Triple G Sales / Griffeth Farms	\$300.00	\$300.00
W&W Farms	\$300.00	\$300.00
West Ridge Farms Inc.	\$300.00	\$300.00
White Farms, Inc.	\$234.00	\$300.00
Willard Doyen & Sons	\$300.00	\$300.00
Willow Pond Farm Inc.	\$300.00	\$300.00
Wright Farms	\$300.00	\$300.00
	\$30,200.00	\$34,800.00
not audited in 2011	\$30,200.00	\$34,800.00
audited in 2012, did not request funds	\$0.00	\$0.00

Lessons Learned

This funding enabled many growers to take the risk of being audited and thereby contributed to safer specialty crop food production in Maine. It will be interesting to compare this number to 2013 audit numbers, when there will no longer be funding available for growers to see if they can be maintained without some type of reimbursement.

Contact Person

AgMatters LLC (Lauchlin & Linda Titus), 1063 Main St., Vassalboro, ME 04989.
207-873-2108 www.agmattersllc.com

Project 2: Enhancing Food Safety Education Utilizing the Latest FDA Rules for Improved Handling and Processing

Final Report – Previously Accepted

Project Summary

This grant was written to help phase in new food safety standards that will be regulations for some and guidance for others as a result of the Food Safety Modernization Act. Many growers feel the future of produce sales will be guided by these standards and they want to find out all they can in order to be prepared for what many think is an inevitable market demand.

This grant offered workshops and updates that introduced the standards to growers. AgMatters LLC's intent was to offer education opportunities to Maine Specialty Crop growers in large group, small group, and individual settings in order to provide the most recent guidance available about minimizing risks as food is grown and processed at the farm and packing house level. We believe that even though "small farms" may be excluded from this legal requirement to conform, they too must be provided the opportunity to be made aware of the research. They also grow produce that is most susceptible to contamination (leafy greens and herbs, tomatoes, peppers, and melons and all things consumed raw).

This grant was written to help introduce new FSMA Produce Safety Rule that will be regulation for some and guidance for others as a result of the Food Safety Modernization Act. Many growers feel the future of produce sales will be guided by these standards and they want to find out all they can in order to be prepared for what many think is an inevitable market demand. This grant offered workshops and updates that introduced the standards to growers. AgMatters LLC's intent was to offer education opportunities to Maine Specialty Crop growers in large group, small group, and individual settings in order to provide the most recent guidance available about minimizing risks as food is grown and processed at the farm and packing house level. We believe that even though "small farms" may be excluded from this legal requirement to conform, they too must be provided the opportunity to be made aware of the research. They also grow produce that is most susceptible to contamination (leafy greens and herbs, tomatoes, peppers, and melons and all things consumed raw).

AgMatters LLC's role was to make growers aware of the new FDA Food Safety Standards; help them to understand them; and advise them on how to incorporate changes in their daily practices that address them. FSMA's Produce Safety Rules were due to come out in January of 2012. However they were not released until January of 2013. AgMatters LLC shared as much as was possible what the implications of the proposed law might be, but had no hard facts until 2013. So AgMatters LLC asked for an extension to this grant so that they could complete their intentions.

Because FSMA will be law, it is important that growers have an idea of what parameters may be imposed on them and have an opportunity to give input about that. Making growers aware of the highlights of the proposed legislation and information on how to make comments on it became the goal of the extension of the grant.

Motivation:

The Food Safety Modernization Act was scheduled to release the Produce Safety Rule in January of 2012 and this grant was timed to coincide with that release. The anticipation was that the Rule would probably not affect small growers, and that much of the Rule would be based on the same documents that GAP/GHP were based on. It was important to Maine Agriculture that growers be made aware of what was occurring nationally and for them to understand the science behind these decisions.

However, the Produce Safety Rule was not released until January of 2013. During 2012, AgMatters LLC did keep questioning FDA to see if and when they expected to release the rule, and they didn't know. FDA did agree to send a speaker in September of 2012 who updated us as much as she could about the Rule. We were told that the rule had been written and was ready for release in January of 2012, but that the election process had put a freeze on its release and we would probably hear something after November 2012. In order to maintain the integrity of this grant, AgMatters sent monthly updates to GAP/GHP growers and everyone who was interested in the bits and pieces that were being released during 2012.

AgMatters met the requirements of the grant, but felt that they still had important work to do after the expected end date of this grant (11/12) so we asked to continue the work, at no cost, in 2013. AgMatters LLC's role was to make growers aware of the new FDA Produce Safety Rule; help them to understand it; and advise them on how to incorporate changes in their daily practices that address them. When the rule was released, AgMatters LLC also took on the role of educating growers about how to make comments about the Rule to FDA.

Project Approach

In order to introduce over 100 Maine Specialty Crop Growers to FDA's science-based minimum standards for safe production and harvesting of fruits and vegetables, especially those consumed in their raw state AgMatters LLC led two half day "Safe Food Handling Workshops". They were advertised on web sites, agricultural newsletters and through email & regular mail. AgMatters LLC sent out regular email updates about the proposed legislation during 2012-2013. AgMatters LLC organized or were guest speakers at over 7 geographic gatherings of growers who sell any produce in order to answer questions growers had about the new standards. AgMatters also sent out an article for the Maine Vegetable and Small Fruit Growers newsletter.

AgMatters LLC focus was on educating all Maine specialty crop growers in the State, including apple growers, vegetable and small fruit growers, wild blueberry growers, organic growers, farmer's market growers, roadside stand growers, and Community Supported Agriculture growers, and potato growers—in short all Maine Specialty Crop Growers. In the 2013 extension of this grant, AgMatters LLC focused its dissemination of data via email distribution list. Additionally, in the extension of the grant, the Maine Department of Agriculture, Conservation & Forestry invited AgMatters LLC to participate in Mike Taylor's (FDA) visit to Maine farms and his team's talk about FSMA, and also to participate in the visit of Under Secretary of Agriculture Edward Avalos. These provided additional opportunities for sharing of information about FSMA.

Objectives of this grant were that:

- Over 100 Maine Specialty Crop Growers will be made aware of FDA's science-based minimum standards for safe production and harvesting of fruits and vegetables, especially those consumed in their raw state.
- At least 2 half day "Safe Food Handling Workshops" would be organized and led by AgMatters LLC and certification of attendance will be given to farmers who physically attend these events with documentation of the number of hours they spent at them. They will be advertised on web sites, agricultural newsletters and through email & regular mail. Pesticide Recertification Credits will be requested from the Board of Pesticide Control for these meetings.
- AgMatters would organize or be guest speakers at a minimum of 7 geographic gatherings of growers who sell any produce in order to answer questions they have about the new standards and to talk about food safety issues that they might want to think about incorporating into their systems. We would give concise up to date information on FDA's science based minimum standards for safe production and harvesting of fruits and vegetables and make growers aware of where resources can be downloaded or how they can be sent to them.

Materials would be put together by AgMatters LLC and hosted on their web site; and printed on paper for those who do not utilize technology. An email distribution list was created of growers and alerts were sent out as release of information by FDA or others occurred.

AgMatters LLC project partners, The Maine Vegetable and Small Fruit Growers Association, the Maine Pomological Society, the Maine Sustainable Agriculture Society, and the Maine Department of Agriculture, Conservation, and Forestry all played significant roles in enabling AgMatters LLC to speak to groups and share the basics of the Produce Safety Rule.

Goals and Outcomes Achieved

Objectives and Outcomes of this grant were that:

- Over 100 Maine Farmers who participate with this grant will be more confident about their knowledge of safe food handling and aware of current recommendations, requirements, and laws that may or may not impact their operations.

Outcome: Surveys/evaluations given at each speaking engagement and meeting will ask those specific questions in order to measure the success of the project. AgMatters LLC will keep these surveys , immediately utilize the information, and include it in the final report.

Result: FSMA Information was sent to over 130 individuals via email four times. We reached approximately 174 farmers directly at meetings in which we spoke. Of those 174, we received back 39 surveys.

Survey results indicated the following:

- Information was clear and understandable 37 yes 0 no
- Written materials were clear and understandable 37 yes 0 no
- As a result of this meeting, do you feel more confident about your knowledge of FSMA?
39 yes 0 no
- As a result of this meeting, are you more aware of current recommendations, requirements, and laws about safe food handling?
39 yes 0 no
- As a result of this workshop, do you know who to contact for more detailed information?
39 yes 0 no
- Will you continue to grow and prosper your farming business? 24 yes 3 no
- Would you recommend vegetable farming as a livelihood to the next generation?
27 yes 2 no
- Please rate the quality of the presentation: 0 Boring 1 Needs Work 36 Right On

Comments: Good energy!

Linda and Lauchlin are friends to farmers! (And Miah etc.!)

Labor will be the biggest issue on our farm in the foreseeable future. Very helpful!

Learned a lot in a very comfortable atmosphere.

2012 Result: Survey results were overwhelmingly positive at each speaking engagement.

2013 Results: By the end of the grant extension, over 300 Maine Farmers who participated with this grant are more confident about their knowledge of safe food handling and aware of current recommendations, requirements, and laws that may or may not impact their operations. The goal was 100.

- Over 100 Maine Specialty Crop Growers will be made aware of FDA's science-based minimum standards for safe production and harvesting of fruits and vegetables, especially those consumed in their raw

state

Outcome: Attendance was recorded at meetings in order to track how many farms are served.

2012 Result: We spoke to over 174 farmers at these various meetings. These meetings were well attended as they were annual or twilight meetings for different groups. The Maine Vegetable and Small Fruit Growers had 60 attendees. The Pomological Society had 10. Sustainable Agriculture Society had 20. One Farm Bureau meeting had 30, and another had 15. A meeting at Stutzman's farm had 20. The meeting in Bangor had 14 attendees and the meeting in Lewiston had 13.

2013 result: By the end of the grant extension, over 300 Maine Specialty Crop Growers were made aware of FDA's science-based minimum standards for safe production and harvesting of fruits and vegetables, especially those consumed in their raw state. The goal was 100.

- At least 2 half day "Safe Food Handling Workshops" will be organized and led by AgMatters LLC and certification of attendance will be given to farmers who physically attend these events with documentation of the number of hours they spent at them. They will be advertised on web sites, agricultural newsletters and through email & regular mail. Pesticide Recertification Credits will be requested from the Board of Pesticide Control for these meetings.

Outcome: Attendance will be recorded at meetings in order to track how many farms are served.

Surveys as to the helpfulness of the information and quality of presentation will be tallied and reported and information will be applied immediately.

Result: Attendance was poor for these meetings. There were 14 at the meeting in Bangor and 13 at the meeting in Lewiston in 2012. We believe that the timing of the meeting (harvest) was the biggest issue. However the non-release of the Produce Safety Rules by FDA made it exceedingly difficult to meet this portion of the goals. That being said, FDA was generous enough to send Joy Johanson to speak at these meetings in order to provide the latest information possible. Survey results were overwhelmingly positive from those who attended the meetings.

For the September meetings, we sent out over 300 regularly mailed invitation letters and 150 email invitations. However the farmer attendance for the meetings was poor as September is the harvest month for crops. We were pleased that we had growers from counties as varied as Aroostook, Washington, and York. We also had several employees of the Maine Department of Agriculture, Conservation and Forestry, as well as several from UMaine Extension. This core group can ultimately help to spread the message to several hundred growers! The grant proposal was written with the understanding that the draft rules would be available in early 2012 and that meetings could be held well ahead of the crop season.

We posted all the Powerpoints used at the meeting on our web site for growers to access at their convenience.

- AgMatters will organize at least 7 geographic gatherings of growers who sell any produce in order to answer questions they have about the new standards and to talk about food safety issues that they might want to think about incorporating into their systems. AgMatters LLC will be guest speakers and give concise up to date information on FDA's science based minimum standards for safe production and harvesting of fruits and vegetables and make growers aware of where resources can be downloaded or how they can be sent to them.

Outcome: Attendance will be recorded at meetings in order to track how many farms are served.

Surveys as to the helpfulness of the information and quality of presentation will be tallied and reported and information will be applied immediately.

Result: These meetings were well attended as they were annual or twilight meetings for different groups. The Maine Vegetable and Small Fruit Growers had 60 attendees. The Pomological Society had 10. Sustainable Agriculture Society had 20. One Farm Bureau meeting had 30, and another had 15. A meeting at Stutzman's farm had 20. The meeting in Bangor had 14 attendees and the meeting in Lewiston had 13. AgMatters will speak to another group or two this fall. Surveys were very positive.

The Maine Department of Agriculture, Conservation and Forestry joined the bandwagon in the fall of 2013 and invited FDA leader Michael Taylor to come to the state to receive input about the proposed rule. The response from the Maine community was overwhelming. Growers were up in arms about the costs associated with the rule and with the unfairness of portions of the rule, such as the manure spreading guidelines and the water testing schedules. AgMatters LLC was invited to participate with the FDA group in several venues and was able to share information with several Maine Agricultural Groups who ultimately sent in comments about the bill while it was in docket. (Agricultural Council of Maine (AGCOM) (100), Maine Farmland Trust (MFT) (estimate of 100), & Maine Farm Bureau (100), amongst others). AgMatters LLC also kept the information flow open with Senator Angus King's office.

AgMatters spoke at over 9 geographic gatherings of growers who sell any produce in order to answer questions they have about the new standards and to talk about food safety issues that they might want to think about incorporating into their systems and made them aware of the opportunity to make comment on the Produce Safety Rule. AgMatters LLC were guest speakers at meetings organized by the Maine Department of Agriculture, Conservation, & Forestry, The Maine Vegetable and Small Fruit Growers, The Pomological Society, The Maine Sustainable Agriculture Society, Farm Bureau, as well as a Twilight Meeting at a farm, a FDA meeting at Spear Farms (30), a FDA meeting at Farm Bureau (35), and a FDA Listening Meeting at the Augusta Civic Center. (several hundred attendees)

- Materials will be put together by AgMatters LLC and hosted on their web site; and printed on paper for those who do not utilize technology.

Outcome: Materials created and dispersed will be tracked and hits on the web site will be tracked.

2012 Result: Thus far, 4 updates have been posted to the web site and the slide presentations from our meetings in September are being added. We have sent out 4 email updates as the law took shape in 2012. (Jan, Feb, April, June)

In 2013, information was sent directly via email by AgMatters LLC to a distribution list we created of over 100 growers and people in Maine Agriculture who wanted updates. This was done on a regular basis, with the final email being sent December 19, 2013 when FDA announced it was going to revise the Produce Safety Rule and then bring it back for comments at a future date.

The Produce Safety Rule was available on our web site, as well as the addresses to give input.. Written comments:

Division of Dockets Management (HFA-305), Food and Drug Administration,
5630 Fishers Lane, rm. 1061, Rockville, MD 20852

Electronic submissions: <http://www.regulations.gov>

It is clear that this grant played an important role in informing Maine farmers and encouraging them to make comments on the Produce Safety Rule. The rule has been taken off track to be revised because of the input from Maine growers.

Beneficiaries

AgMatters LLC focus was on educating all Maine specialty crop growers in the State about proposals in the Produce Safety Rule that they might have to work with. These included apple growers, vegetable and small fruit growers, wild blueberry growers, organic growers, farmer's market growers, roadside stand growers, and Community Supported Agriculture growers, and potato growers—in short all Maine Specialty Crop Growers. Therefore, **the potential impact was on all Maine Specialty Crop growers and ultimately on consumers of local produce in the State of Maine and beyond.**

The fact that the Produce Safety Rule is being revised by FDA indicates that there were some big problems with portions of it. We believe that all growers will directly benefit by revision of the manure standards and the water standards, and other portions as well. The financial impact of the Rule appeared to be more than intended, especially on Maine growers.

Lessons Learned

The biggest problem fulfilling the goals of this grant was the delay in release of the Produce Safety Rules by FDA. Although there are other portions of FSMA that will affect growers, the biggest piece of the law, the Produce Safety Rules, were released in January 2013, a year later than scheduled.

In order to meet the goals of this grant, we planned two September (2012) meetings with Joy Johanson from the Produce Safety Staff with the Office of Food Safety at CFSAN at the FDA to give an overview of **FSMA** and talk about the **Produce Safety Rule** of the law. We were still waiting for the Produce Safety Rule and running out of time with the grant. The meeting offered pesticide recertification credit and included an interactive piece amongst the audience on the future of Maine's Specialty Crop markets and suggestions on how growers can prepare for and capitalize on changes in the industry. Although almost 250 written invitations and 130 email invitation were sent out and only 30 individuals attended. There is no good time to hold a meeting in Maine from May 1 to November 15 for growers. We knew that, but were forced by delay in release of information, to forge ahead.

Although AgMatters LLC met the stated goals of the grant by October 2012, the actual Produce Safety Rule had still not come out. AgMatters LLC continued attending meetings of growers and updating them from Oct. 2012 through November 2013 via email and by speaking at meetings. AgMatters believes it met and surpassed the goals of this grant.

Contact Person

AgMatters LLC
Lauchlin, Linda, and Jeremiah Titus
1063 Main St. Vassalboro, ME 04989
207-873-2108 ltitus21@myfairpoint.net www.agmattersllc.com

Project 3: Maine Potato Integrated Pest Management

Final Report – Previously Accepted

PROJECT SUMMARY

The \$500 million potato industry is the largest agricultural sector in Maine. The management of insects, diseases, weeds, and other pests is integral in sustaining a healthy Maine potato crop. Without reliable and sustainable pest management strategies, Maine's potato industry faces the potential of severe crop losses resulting in significant reductions in profits and threats to long-term viability. The current market demand for perfect, pest and damage-free produce and crops, combined with the public's desire to decrease pesticide use for human health and environmental reasons, comes at a time when Maine potato growers face ever increasing production costs and pest pressure. Potato growers are increasingly relying on a multidisciplinary Integrated Pest Management (IPM) approach to ensure that Maine's potato crop is pest and damage free while attempting to minimize the amount of pesticides that are applied.

The increasing number of emerging pests and diseases in Maine, including potato mop-top virus, potato wart (a quarantinable pest), necrotic strains of potato virus Y (PVY), white mold, nematodes, and new strains of potato late blight, indicate a significant need for research and educational outreach. In order to mitigate the risks associated with existing and emerging potato pests, a close and direct connection between growers and the University of Maine Cooperative Extension Potato Integrated Pest Management (IPM) Program is vital. Through this project, information gathered through multiple sources, including direct observation, trapping, weather data, and predictive modeling, was delivered to stakeholders in Maine and throughout the region via electronic and standard newsletters, websites, and telephone message centers. The data produced continues to help IPM scientists track potential pest outbreaks and provides growers with current information on specific and timely treatments in order to minimize the number of pesticide applications and maximize potato yield. This project builds upon previous project funding from the Specialty Crop Block Grant Program (SCBGP) that have allowed for continuation of University of Maine Cooperative Extension's potato pest monitoring and research efforts.

PROJECT APPROACH

Staff involved:

James Dwyer, Crops Specialist, University of Maine Cooperative Extension
James Dill, Pest Management Specialist, University of Maine Cooperative Extension
Griffin Dill, IPM Professional, University of Maine Cooperative Extension
Steve Johnson, Crops Specialist/Plant Pathologist, University of Maine Cooperative Extension
Bruce Watt, Disease Diagnostician, University of Maine Cooperative Extension Sean McAuley, Scientific Technician, University of Maine Cooperative Extension Meghan Dill, Administrative Assistant, University of Maine Cooperative Extension Donald Flannery, Maine Potato Board
Tim Hobbs, Maine Potato Board
Fourteen seasonal program aides

Activities Performed:

In cooperation with the Maine Potato Board, University of Maine Cooperative Extension implemented a comprehensive integrated pest management program for potato growers. Fourteen seasonal program aides surveyed 70 potato fields on a weekly basis during the growing season. These fields were located in the potato

producing areas of northern and central Maine. Information from the surveying effort was communicated to the Potato Industry via a weekly newsletter, a website and a telephone hotline. During the growing season, monthly meetings were held with the field and technical staff of local companies, which provide service to potato growers.

A special program was held for field workers to identify Potato Virus Y and Potato leaf Roll Virus symptoms. This “Roguing School” was targeted towards field workers who surveyed fields for diseased plants. A Potato Pest Management Conference was held in December to update technical field staff and growers on the latest potato pest management research from the University of Maine.

Project Results

For the 2013 crop season the University of Maine Cooperative Extension’s Potato IPM program:

- Monitored: 70 potato fields on a regular basis.
- Operated: 50 Heliiothis style pheromone traps for European corn
- Operated: 60 sticky type pheromone traps for European corn borer.
- Operated: 70 yellow pan water traps for aphid collection.
- Operated: 8 pheromone traps for Black cutworm detection.
- Operated: 5 Black light traps for European corn borer

Client contacts made:

- 2500 individual personal grower contacts, May through September.
- A weekly newsletter with current regional pest updates was emailed to approximately 375 industry staff in Maine, New Brunswick and Eastern United States. 9 issues were written.
- Three issues of Spudlines, a periodic newsletter regarding pertinent potato pest/crop management matters, was distributed to a mailing list of approximately 780 individuals.
- Pest information was posted on www.maine potato ipm.com
- Pest information was posted on a telephone hotline which received 1920 calls June through September.

Cooperation:

- Maine Potato Board hosted six monthly meetings for the field and technical staff of companies and agency staff that work with potato growers to get the latest information on pest issues.
- Seventy grower cooperators directly participated in the program by having field scouts survey their farms.
- Consultants brought disease and insect samples to the Presque Isle Cooperative Extension office and the Pest Management Office in Orono for identification.

Monitored Chain Retailer Stores:

- Plant material capable of hosting potato late blight was monitored at chain retailer stores in northern and central Maine. Stores were monitored on a weekly basis. In 2009 potato late blight was detected at multiple big box stores throughout the state of Maine. The infected plant material was being sold and distributed throughout the state. No potato late blight was detected at these stores in 2013, however, green peach aphid were found on green pepper seedlings. The Maine Dept. of Agriculture interceded to rectify the problem.

Trained at Potato IPM Scout School:

- Trained Twenty individuals who included chemical sales staff, on farm employees, consultants and others. Training included information on:
 1. Potato Late Blight identification
 2. aphid identification

3. European corn borer identification
4. Colorado potato beetle identification
5. secondary pest identification
6. economic thresholds
7. scouting techniques
8. insect models for Maine producers
9. disease models for Maine producers

Trained at Potato Pest Management Conference:

- 125 individuals attended the 2013 Maine Potato Pest Management Conference, which updated growers and technical staff on the latest pest management research information, which included:
 1. Aphid collection results and management strategies
 2. PVY survey and results
 3. Update on insecticide control studies
 4. Update on potato storage diseases
 5. Update from the Maine Board of Pesticides Control
 6. Slug Issues and Management
 7. Late blight update

Trained at Maine Potato Conference:

- 250 individuals attended the January 2013 Maine Potato Conference, which provided growers, technical staff, and potato industry personnel with information regarding:
 1. PVY management
 2. Potato late blight management
 3. Detection and management of wireworms
 4. Detection and management of aphids

GOALS AND OUTCOMES ACHIEVED

A primary goal of this project was to effectively identify and respond to the insect, weed, and plant disease issues facing Maine's potato growers. Through the intensive monitoring program and subsequent educational outreach (via informational websites, hotlines, newsletters, conferences, and grower meetings) associated with this project, potato pest issues were effectively managed, ultimately resulting in a multimillion dollar economic impact on Maine's potato industry (as described in the BENEFICIARIES section).

Another primary goal of the project was to increase implementation of IPM among potato growers. Each year the University of Maine Cooperative Extension brings together Potato IPM program participants, technical service representatives and early adopter growers for the annual Potato Pest Management Conference. The goal of the conference is review pest issues of the previous growing season as addressed by the Industry and the Potato IPM program as well as to bring the latest research information on potato pest management strategies to the Industry.

A written evaluation was completed by the participants. Eight percent of the participants felt the because of the program they were better able to make better pest management decisions that created an impact of between \$500 and \$1000. Two percent of the participants felt the information would create and influence of between \$1000 and \$2000; Eight percent between \$2000 and \$5000. Twenty-four percent of the participants felt that the information gained from the program would create greater than a \$5000 impact within their farming operation. This equates to program participants indicating that increasing their knowledge base could have a potential

\$668,000 positive impact on the Maine Potato Industry from better decision making as a result of this program. A review of the Potato IPM program was also provided to the Aroostook County Extension Association.

Through the educational outreach associated with this project, additional objectives including an increase in grower awareness of potato pest issues, increased grower knowledge of pesticide risks, and minimization of pesticide use through the implementation of IPM practices, were achieved.

BENEFICIARIES

The beneficiaries of this project include all of Maine's 400 commercial potato growers and their approximately 59,000 acres of potatoes, national and international growers who rely on Maine's seed potato crop, hobby farmers and backyard gardeners, as well as a multitude of researchers and industry personnel who utilize the information generated from this project.

Economic Impact:

- 14 seasonal program aides were provided with summer employment.
- During the 2013 growing season in Maine potatoes colonizing aphid populations were very low for most of the season, but in August colonizing aphid populations rose significantly. Non-colonizing aphid populations were very active during the entire growing season. The Potato Industry was alerted to this activity. Some seed growers utilized stylet oil, a non-traditional insecticide because non-colonizing aphids are capable of transmitting Potato Virus Y and traditional insecticides do not prevent these aphids from transmitting virus. It is too early to determine economic impact for the aphid work this year.
- In 2013 European corn borer populations were lower than in past years and 11% of the farms monitored exceeded economic threshold levels for European corn borer.
- 57,000 acres X 11% (number of farms exceeding threshold levels) = the number of acres potentially impacted. 6,160 acres
- 6,160 acres X 275 cwt/a X \$8/cwt X 10 % potential yield loss = **\$1,355,200 loss avoided.**
- Colorado potato beetles: Thirteen farms exceeded economic threshold levels for Colorado Potato beetles:
57,000 acres X 18% of farms exceeding threshold = 10,260 acres potentially impacted
- 10,260 acres X 275 cwt X \$8/cwt X 10% potential yield loss = **\$2,257,200 losses avoided**

Economic impact from the insect monitoring aspect of the program for the 2013 season is currently being estimated at \$3,612,400, an approximately 27 to 1 return on investment.

LESSONS LEARNED

As a result of this project, the changing nature of potato pest dynamics has become more evident to the project staff. The emergence of new pest threats as well as the ever changing weather variables forces project staff, growers, and potato industry personnel to adapt pest management techniques to a rapidly evolving system. Weather and changes in pest profiles present a challenge when implementing a crop pest management system. New strains of potato late blight have been introduced into the state of Maine. These new strains have differences in how they react to the weather and their sensitivity to some fungicides. Late season rains were

conducive to increased slug populations and some growers realized 5% or greater damage to their tubers.

The issue of non-persistent virus transmission and non-colonizing aphids is a topic on which more research is needed. New strains of potato virus Y have been introduced into North America, which can cause an internal necrosis in potato tubers. These new virus strains have the potential to cause a significant negative impact for seed, table and processing producers.

The European corn borer population in the northern part of the state of Maine appears to be different from the population in central and southern Maine. In the northern area, there appears to be a strain difference, therefore a combination of pheromone traps and black light traps are utilized. Black light trapping is highly effective, but very costly and very time consuming.

Rain events make keeping regular field monitoring schedules impossible at times. Adapting to weather events is one of the challenges which any field based program encounters.

There is an anticipation that IPM programs will always reduce pesticide usage, due to changing weather and pest pressures, sometimes pesticide usage is reduced and sometimes the usage is increased in order to maintain produce quality. The utilization of an IPM approach in potato cultivation remains popular and continues to increase in use.

CONTACT PERSON

Don Flannery, Executive Director
Maine Potato Board
744 Main Street, Suite 1 (207) 769-5061 flannery@mainepotatoes.com

Project 4: New Potato Varieties to Provide Marketing Opportunities and Improved Pest Resistance

Final Report – Previously Accepted

Project Summary

The intent of this proposal was to steadily improve the Maine Potato Breeding Program to assure that it provides a high level of service to the industry over time

The Maine Potato Breeding Program uses traditional plant breeding techniques to create, select, and develop new potato varieties. Parents for our crosses come from diverse sources including our own breeding clones, other North American and European breeding programs, the International Potato Center, the USDA-ARS Potato Germplasm Collection in Sturgeon Bay (WI) and USDA potato germplasm improvement programs. Initial selection is conducted primarily in northern Maine; however, we cooperate with several other programs in the United States and elsewhere to select and evaluate our plant materials these programs include: NC, WI, ND, and USDA-ARS Idaho. Research collaborations with Dr. Benildo de los Reyes are adding a molecular component which we hope will help speed the selection process for new traits (e.g. pink rot resistance).

Crosses conducted in the University of Maine's Aroostook Research Farm greenhouse during winter/spring typically result in about 200 families and 250,000 true potato seed (TPS) annually. Seedlings from the prior-year TPS production are planted in the greenhouse during the spring and result in the production of up to 30,000 seedlings "A" tubers. The greenhouse seedling crop also produces up to 30,000 "B" and "C" tubers. The majority of the "B" and "C" tubers are sent to cooperating breeding programs (e.g. the USDA-ARS Aberdeen, ID and the University of Wisconsin). This exchange of seedling tubers allows our breeding materials to be evaluated and selected under diverse environmental conditions. In turn, our program receives seedling tubers from both of these programs. This coordinated potato germplasm exchange is one of several activities that we participate in to help improve the efficiency of potato germplasm utilization within the North American potato breeding programs.

The Maine Potato Breeding Program is now planting 45-50,000 single-hills at the Aroostook Research Farm each season. These single-hill plots were derived from greenhouse tubers grown during the previous year (by our program, the USDA-ARS Aberdeen, and U. of Wisconsin) and represent the first year of field selection to produce new potato varieties. At harvest, clones from the single hills (typically 1-2%) are selected for further evaluation based on their yield and appearance. The clones will be evaluated in our 8- and 12-hill plots during the next season and enter replicated yield trials in their fourth field season. Over the course of six years of field selection the clones are evaluated for yield, quality, disease resistance, bruise susceptibility, processing characteristics, and other attributes. It takes six to eight field seasons of selection and evaluation of the advanced materials at multiple trials sites to identify potato clones that show enough promise to warrant commercial-scale evaluation. Because each step of the process from crossing through initial field selection to multi-site testing of advanced materials takes place each growing season, we anticipate that our program will generate a steady stream of promising candidate potato varieties that have the potential to benefit the potato industry.

For the past 18 months, we have made a series of improvements in the breeding program that should pay off in the future with a steady stream of strong candidate varieties to be considered for commercialization. These improvements have initially focused on improvement of the program's selection procedures; however, increasingly they will be shifted to upgrading the program's variety development efforts. Some of the improvements that have occurred over the past 18 months are as follows:

Breeding and Selection

- Doubled our single-hill selections to 45,000 to 50,000 annually.
- Expanded early-selection of our materials in NC and NJ to better identify promising clones for Maine's seed markets in the SE states.
- Set up germplasm exchange and evaluation programs with USDA-ARS Idaho, ND, and WI. In addition to bringing in russets to select under our growing conditions, this effort has brought an infusion of reds, chippers, and disease-resistant germplasm from these programs.
- Expanded our multi-site evaluation program to better select promising, widely adapted clones.
- Developed a database for managing information from the multi-site variety trials. This database is essential for decision-making and summarizing results over many trials.
- Strengthened protocols for determining processing quality bruise susceptibility, and boiled/baked quality.
- Improved our screening procedure for late blight resistance by collaborating with Penn State. Late blight resistant clones are now identified 3-4 years earlier than in the past.
- Re-established cooperative program of GN screening with USDA-ARS, Ithaca.
- Incorporated pink rot resistance screening into the program with the help of Dave Lambert.
- Initiated a study to develop molecular tools to screen for pink rot resistance with the help of David Lambert and Benildo de los Reyes.
- Reestablished an effective fusarium resistance screening protocol.
- Submitted AF clones to national late blight, scab, and verticillium resistance screening trials.
- Participated in the SolCap program, which is geared toward expanding the use molecular tools in potato and pepper breeding and selection.
- Participated in seven collaborative research proposals with other institutions including USDA-ARS, University of Minnesota, North Carolina State University, Cornell University, Michigan State, and Penn State. Only one proposal, the USDA CSREES Special Grant for Potato Research was funded.

Variety Development and Commercialization

- Improved our partnership with the Maine Seed Potato Board seed propagation facility and submitted eleven advanced clones to the facility for clean-up, tissue culturing, and initial seed propagation on a paid basis.
- Worked with Aroostook Research Farm to generate certified seed of advanced clones for entry into commercial-scale trials through the New Potato Variety Challenge Grant Program.

- Re-established variety development linkages and set up advanced clone evaluations with potato processors.
- Established an industry advisory panel (ad-hoc Variety Development Advisory Committee) to guide variety development and seed increase decisions.
- Entered a promising chipper into the USPB/SFA national variety trial.
- Publicized the program's efforts through presentations and a booth at the Maine Potato Conference, TV interviews, an industry-organized article in Spudman, and other press releases.

Project Approach

The Maine Potato Board was awarded a contract in the amount of \$54,000 on November 12, 2010 to provide marketing opportunities and help solve pest/disease problems through the development and selection of new potato varieties.

The University of Maine Potato Breeding Program used traditional plant breeding to create, select, and develop new potato varieties for Maine and elsewhere. The objective of this research was to develop and select new potato varieties which will provide those opportunities to the Maine Potato Industry. During 2011 our research effort by market category was as follows: 60% russets and long-whites for processing and/or fresh market; 30% whites for chipping and/or fresh market; and 10% reds and specialty varieties. The Maine breeding program is the only eastern U.S. program with an emphasis on russets and long-whites with processing and fresh market potential. Priorities in the area of disease resistance were: late blight, scab, and pink rot. Because of increasing concerns about PVY in the U.S. potato industry, we dramatically increased our crossing and selection program for PVY resistance. Although these diseases were our top priorities, our work on disease and pest resistance also included efforts to develop varieties with resistance to: PLRV, verticillium wilt, fusarium dry rot, nematodes, bruising, internal defects, insects, etc.

Progress on Russets/Long Whites: We currently have 11 advanced russet/long-white clones (AF3000-1, AF3001-6, AF3008-3, AF3317-15, AF3362-1, AF4040-2, AF4113-2, AF4124-4, AF4124-7, AF4172-2, and AF4191-2) in processing trials with McCain Foods and more than a dozen promising candidate clones immediately behind these. McCain Foods provides key collaboration in the selection phase, through processing quality evaluations at their technology center, and to champion adoption of the most promising clones. More detailed information on three of these clones is provided later in the report. We are actively participating in U.S. Potato Board and USDA-NIFA SCRI projects designed to improve the quality of processed potato products. Nineteen russet clones from the program were tested in Idaho, Washington, and North Dakota as part of this effort during 2011.

Progress on Whites and Chippers: AF0338-17 is being tested as an alternative to Atlantic in the S.E. states. It combines high yields, good out-of-field chipping, and much less internal heat necrosis and hollow heart than Atlantic. AF4157-6 is a promising chipping clone that combines early maturity and good out-of-field chipping in the southern states with excellent storage chip color. Seed is being increased for expanded trials in 2012. AF4013-3 is a yellow-fleshed clone that did well in 2011 trials in the eastern U.S. AF2291-10 is a "northern chipper" and has high gravity, good early blight resistance, moderate scab resistance, and generally good yields. AF2574-1 finished its third year of commercial trials in northern Maine. It is a fresh-market white with

very high yields, good internal quality, and late blight resistance. It has performed well in northern Maine, but does not have good tuber appearance in the south or mid-Atlantic. Additional promising clones are coming along behind these clones.

Progress on Reds and Specialty Types. Growers have expressed a strong interest in new red varieties that have smooth skin, attractive appearance when grown on our soils, and the ability to hold their color in storage. Reds are a critical component of the seed potato market and new, well-adapted reds will provide opportunities for our seed growers, especially in VA, NC, FL, and other southern states. Varieties in these classes provide an opportunity for market differentiation and new, higher-value markets for Maine potatoes. This is a new component of the breeding program which was established based on grower input. Red-skinned, greenhouse-grown seedling tubers brought in from WI, ND, and ID have been screened in ME since 2008 and entered testing in FL, NC, and NJ during 2010. Several are showing excellent potential and seed of the most promising is being multiplied so that they can be tested on a larger scale during 2012.

Progress of Disease Resistance: Advanced clones in our program typically have resistance to several important potato pests. As examples, McCain Foods had three of our clones in 2011 commercial strip trials: AF3362-1 has resistance to scab as well as excellent bruise resistance; AF3001-6 has excellent verticillium resistance, while AF3317-15 has very good resistance to late blight, scab, and pink rot. AF2574-1, a round-white in commercial trials since 2009 has good late blight resistance and very high yields. Progress in breeding for late blight resistance has been dramatic. We currently have 84 late blight resistant, third-year or more advanced clones moving through the program and more coming behind them. The clones will be moved forward based on field performance and either developed for commercial release or used as breeding material to produce future commercially valuable cultivars with good field resistance to late blight. These cultivars would reduce the vulnerability of the crop to losses from late blight and would potentially allow growers to reduce their fungicide costs.

Scab resistance is a high priority for our program and for most growers that I talk with. We are working hard to select promising scab resistant varieties in each market class, as well as increasing the scab resistance in our parental material and improving our selection procedures. PVY has become a severe problem for the industry and our breeding program has responded to this problem by increasing the number of PVY resistant parents in our seedling families and crosses as well as by working to improve our selection criteria.

Breeding and Selection Approach: Crossing takes place at Aroostook Research Farm using parents from our program, Cornell University, Michigan State, North Dakota State University, University Wisconsin, and the USDA-ARS, as well as named varieties. We generate true potato seed from the crosses and use these seeds to produce greenhouse seedling tubers. Excess greenhouse tubers are exchanged with the USDA-ARS Idaho, North Dakota, and Wisconsin breeding programs to gain access to russets, reds, and chippers that will strengthen our program's ability to provide new varieties for the Maine industry.

Crosses conducted in the Aroostook Research Farm greenhouse during spring 2011 resulted in 61 families and 25,300 true potato seed (TPS). The top priorities represented in the 2011 crosses were improved russet, processing, and chipping clones, especially with late blight, scab, and or virus resistance. Seedling tubers (45,224) from prior ME crosses and from germplasm exchanges with other breeding programs (WI, USDA-ARS, and ND) were planted in the field and selected for performance under ME growing conditions. We selected 1174 (2.6%) for continued evaluation in 2012. By category the selections were as follows: 535 (46%) round to oblong white-skinned potatoes for fresh and/or chipping markets; 159 (13%) red- or purple-

skinned potatoes for fresh market or processing; and 480 (41%) long-tuber-type whites and russets for fresh and/or processing markets. The selection of 13% red- or purple-skinned potatoes is a marked change for the program and reflects grower interest in developing red-skinned varieties with excellent appearance under ME conditions.

A total of 367 second-year clones were selected during fall 2011 (367 out of 1423, 25.8%). Of these selections, 139 (38%) were russets or long whites. There were 179 round-white selections (49%) and 49 (13%) were red- skinned or specialty clones. Many of these clones were derived from parents with late blight and/or other key disease resistance traits. Chip/fry color was used as a selection criterion for the whites and russets. The 367 selected second-year clones will be advanced to 3rd year testing during 2012.

Nineteen of 33 (60%) advanced selections (6th year or older clones) were retained for further evaluation in ME and elsewhere during 2012. The advanced clones that have been selected to date are distributed as follows: 10 russets and long whites (53%), 7 round-whites (37%), and 2 yellow-fleshed (10%). Thirteen of 33 (39%) intermediate selections (5th year clones) were retained for further evaluation during 2012. These were distributed as follows: 10 russets and long whites (77%), 3 round-whites (23%), and 0 colored skin or specialty clones (0%). Forty-four of 84 (52%) 4th year clones were retained for further evaluation during 2012. These were distributed as follows: 14 russets and long whites (32%), 20 round-whites (45%), and 10 colored skin or specialty clone (23%). Sixty-nine of 215 (32%) 3rd year clones were retained for further evaluation during 2012. These were distributed as follows: 26 russets and long whites (38%), 28 round-whites (41%), and 15 colored skin or specialty clones (22%).

Minitubers, N1, or N2 seed of the following advanced clones are available from the Maine Seed Potato Board or will become available after the 2012 harvest: AF2291-10, AF2574-1, AF0338-17, AF3001-6, AF3317-15, and AF3362-1.

Current Top Advanced Prospects for Commercialization Seed of these clones is currently available from the Maine Seed Potato Board, Maine seed growers, and/or Aroostook Research Farm. Additional clones in each marketing class will become available over the coming years.

AF0338-17 (AF303-5 x SA8211-6), a widely-adapted, mid-season, high yielding, round white for out- of-field chipping and fresh market. It has performed well in the S.E. and Mid-Atlantic States with U.S. #1 yields averaging 96% of Atlantic. Specific gravity has averaged 4 points lower than Atlantic. AF0338-17 has chipped well from the field and has had much lower incidence of internal defects than Atlantic. It is moderately susceptible to scab, but has moderate verticillium resistance. Seed Availability: Maine certified seed (see ME seed book), Maine Seed Potato Board N1 and N3 seed and disease-free plantlets or minitubers; ~40 cwt. of University of Maine seed.

AF2291-10 (SA8211-6 x EB8109-1), a chipping prospect for northern areas. AF2291-10 has high specific gravity, moderate scab resistance, and medium-late to late vine maturity. It has chipped from June storage in Ontario trials. It can be prone off shapes and has blackspot bruise susceptibility similar to Snowden. It is not well adapted to production in the S.E. states. Seed Availability: Maine certified seed (see ME seed book), Maine Seed Potato Board N2 seed tubers and disease-free plantlets or minitubers; ~65 cwt. of University of Maine seed.

AF2574-1 (AF2153-2 OP), a fresh-market white with moderate late blight resistance. AF2574-1 is late maturing and has good internal quality and high yields. U.S. #1 yields have averaged ~120% of standard round-white varieties (Atlantic and Katahdin) in Maine trials. Tuber sizing is good, but external appearance has been inconsistent. It is not well adapted to production in the S.E. and Mid- Atlantic States. AF2574-1 is moderately susceptible to scab. It has been commercially tested in Northern Maine for three years with good results. Seed Availability: Maine Seed Potato Board N2 seed and disease-free plantlets or minitubers; ~24 cwt. of University of Maine seed.

AF3001-6 (Silverton Russet x AF1668-60), a widely adapted, late maturing, long-white with netted skin, very good fry color, and high yields. AF3001-6 is very good baked, boiled, and mashed. U.S. #1 yields have averaged ~127% of standard russeted varieties (usually Russet Burbank) in Maine trials. Specific gravity is moderate (average of 1.086 in ME trials) and fry color from storage has been excellent. It is moderately susceptible to scab, but has good verticillium resistance. Seed Availability: Maine Seed Potato Board N1 and N2 seed and disease-free plantlets or minitubers; ~20 cwt. of University of Maine seed.

AF3317-15 (AWN86514-2 x Reeves Kingpin), a long russet with late blight resistance and potential for fresh market and processing. AF3317-15 is very good baked and mashed. AF3317-15 has very late vine maturity and long tubers with russeted skin. It can yield well when given a long growing season, but needs a lot of time to develop and mature tubers. Specific gravity is moderate (average of 1.085 in ME trials) and fry color from storage has been fair to good. It has resistance to late blight, common scab, and pink rot. Seed Availability: Maine Seed Potato Board disease-free plantlets, minitubers, or N1 seed; ~14 cwt. of University of Maine seed.

AF3362-1 (Reeves Kingpin x Silverton Russet), a mid-season, long russet with good yields, processing potential, and fair to good appearance. AF3362-1 is very good baked and mashed. U.S. #1 yields have averaged ~110% of standard russeted varieties (usually Russet Burbank) in Maine trials. Specific gravity is moderate (average of 1.084 in ME trials) and fry color from storage has been mostly good. It has moderate scab resistance. AF3362-1 is susceptible to internal heat necrosis and should not be grown in the S.E. states or other areas where this defect is frequently observed. Seed Availability: Certified Maine Seed (see ME seed book), Maine Seed Potato Board disease-free plantlets, minitubers, or N1 seed; ~25 cwt. of University of Maine seed.

AF4013-3 (MonDak Gold x SA9704-1), a mid-season, oblong to round, yellow with pink eyes and good yields, moderately-high gravity, good chip color, and good appearance where scab is not a problem and tuber size is controlled. U.S. #1 yields have averaged ~93% of standard varieties (usually Atlantic; one site with severe scab was dropped from this calculation) in Maine trials. Specific gravity is moderate to high (average of 1.090 in ME trials) and fry color from storage has been mostly good. It is susceptible to scab. AF4013-3 has potential for specialty fresh market, chipping, and processing on fields where scab is not a concern. Seed Availability: ~15 cwt. of University of Maine seed.

AF4157-6 (Yankee Chipper x Dakota Pearl), an early to mid-season, round to oblong white with good yields, moderately-high gravity, very good chip color, and fair to good appearance. U.S. #1 yields have averaged ~110% of standard varieties (usually Atlantic) in Maine trials. Specific gravity is moderate to high (average of 1.091 in ME trials) and fry color from storage has been mostly good. It is susceptible to scab. AF4157-6 has potential as a chipper in southern states and in northern states on fields where scab is not a concern. Seed Availability: ~15 cwt. of University of Maine seed. AF4157-6 has been entered into tissue culture for future seed production.

Goals and Outcomes Achieved

Measurable outcomes of this project are the complete evaluation of all new varieties coming out of the Maine Potato Breeding Program. Each year all varieties are evaluated to determine if they have what it will take to find a place in the potato industry. Every year new varieties are entered into the program and old ones that don't meet the needs of the industry are taken out.

Once the evaluations are complete new varieties are put into commercial trails where the final determination will be made if there is a viable commercial market for the variety. Success is determined by how many varieties are actually accepted by the commercial market.

All information gathered from the research undertaken as part of the Potato Breeding Program is published annually and made available to growers and processors in Maine. The information provided allowed them to determine if a new variety from the program has the ability to become viable in commercial production.

Beneficiaries

The beneficiaries of this research are our 350 potato growers in Maine. Successful development of a new potato variety can provide many economic benefits to the Maine potato industry including over 350 growers, potato processors and potato dealers as well as the ultimate beneficiary, the potato consumer. New varieties enhance marketing opportunities (e.g. high quality varieties for processing, fresh market, or seed use) or they can improve profits by providing improved yields for an existing market. They can also improve profits by reducing losses to disease (e.g. better scab, fusarium, or blight resistance) or by decreasing the costs required to control a disease (e.g. blight resistance reduces the number of sprays required to control the pest).

Lessons Learned

Potato breeding is a long term commitment. The University of Maine breeding program has many years of potato breeding experience, and is committed to providing potato breeding research into the future. There are some promising varieties that are currently in the program we are excited to see what the future holds for opportunities to commercialize these varieties.

Contact Information

Dr. Greg Porter

207-581-2943 porter @maine.edu

Project 5: Development and Implementation of a Disease Integrated Pest Management Program for Maine's 575 Wild Blueberry Growers.

Final Report

PROJECT SUMMARY:

Disease control is a limiting factor in growing the size of the Maine wild blueberry crop. State of the art disease IPM practices are necessary to maintain the yield gains made over the last 40 years with improved management of other aspects of the crop.

Mummy berry disease of blueberries, caused by *Monilinia vaccinii-corymbosi* can decrease wild blueberry yields up to 80% by killing flower and leaf buds and infecting developing fruit. This disease is found in the majority of Maine's wild blueberry fields in varying severity and is currently the number one economically damaging disease affecting wild blueberry growers. Prior to 2006, the majority of wild blueberry growers in Maine applied 2 to 3 fungicide applications to control this disease using a calendar method by estimating when bud break had occurred and then applying fungicide every 7 to 10 days until they determined the leaf and flower buds were open, which was assumed to be when the plants were no longer susceptible.

Unfortunately, the calendar method does not take into account variations in weather conditions and development of the plants and fungus, so in most years there was incomplete control of this disease as well as ill-timed and unneeded applications of fungicides. A mummy berry forecasting model (MBFM), developed by Rick Delbridge and Paul Hildebrand for lowbush (wild) blueberries in Nova Scotia, incorporates tracking of weather events and the stages of development of both the plant and fungus to determine the risk of infection occurring and therefore whether or not fungicides need to be applied. The duration of wetness on the leaf and flower buds and average temperature during that wetness event is needed to determine the risk of infection in the MBFM. This type of data can only be obtained from specific leaf wetness and temperature weather stations.

In the spring of 2007, a pilot mummy berry forecast was provided as a recorded phone message for growers by Dr. Seanna Annis. There was a low level of adoption of the MBFM in Maine prior to 2009 due to lack of awareness, limited knowledge of disease dynamics and training of growers, lack of research demonstrating the method under growing conditions in Maine, and lack of equipment to gather suitable weather data. A Northeastern Integrated Pest Management Center grant from 2009 to 2011 supported a trial Mummy Berry Forecasting System (MBFS) which included: demonstration plots comparing the timing of fungicide applications using the calendar and forecasting methods; extension education for growers and funding for travel to assess "mummy berry plots;" and the establishment and maintenance of a limited network of first generation MBFS weather stations. The forecast information was provided twice a week during the spring of 2009 to 2011 on a blog (<http://mainewildblueberries.blogspot.com/>), sent by email list, and as recorded phone messages.

As of March 2011, 72% of 139 survey respondent wild blueberry growers use fungicides to control mummy berry, and 65% have heard of the forecast method. Of the 73 growers who answered the question, 86 % follow the recommendations of the forecast method at least sometimes, and 60% said it affected how they applied fungicide. Ninety five percent of the growers surveyed in March 2011 wanted the mummy berry forecast system to continue.

Objective number 1 took the Mummy Berry Forecasting System to a fully operational level by setting up a weather data collection system using weather stations that upload data via cellular phone modems to a website making the data easily accessible at any time. This system allowed placement of the weather stations in more locations and collection of weather information every 20 minutes to allow forecast recommendations in a more timely manner.

Wild Blueberry growers utilizing control options within the context of an IPM system are currently dependent on two fungicides, propiconazole and fenbuconazole to control mummy berry disease. These fungicides have the similar modes of action and have been relied on by growers over the last dozen years. Resistance to propiconazole, the material of choice, has not been seen in wild blueberry fields yet; however decreased sensitivity to this fungicide has been found in laboratory experiments in the Annis lab at the University of Maine. Resistance management is a key component of a well designed IPM system. Effective, alternative control materials are needed for the mummy berry IPM system.

Objective number 2 screen new materials for control focusing on reduced risk options for two years. Identifying alternative control options also reduces market risk in case a material becomes unacceptable for use for a foreign market or non-target effects on other organisms become a concern thereby limiting use of a control material.

Valdensinia leaf spot is a newly emerging fungal disease that causes young leaves to drop off soon after they are infected in the spring. Heavy infections can result in complete leaf loss early in the growing season which can result in severe yield loss. Yield reductions of greater than 60% have occurred in Nova Scotia in lowbush blueberry fields where this disease has become widespread. The fungus has been demonstrated to spread within a field by movement of infected leaves on contaminated footwear, clothing, vehicles, or other equipment, and this may be one of the methods of spread to new fields.

In 2009, the disease was confirmed for the first time in Maine in 12 commercial lowbush blueberry fields, and was found in 7 additional fields since 2009. The disease could spread throughout the blueberry growing areas of Maine and be devastating to the industry. So far, the only method of control of this disease appears to be a hard burn of affected areas to destroy all infected leaf material, and this only works well if the disease is in a small enough area to burn effectively. In 2011, there were no fungicides labeled for control of this disease in the USA, and these will become necessary if this fungus cannot be eradicated by cultural methods from fields and becomes widespread in Maine.

The third objective was to test fungicides for the prevention of early infection by *Valdensinia leaf spot* as a pro-active step to minimize the need of fungicide treatment during the full 2 year cropping cycle and to control this disease if cultural eradication methods do not work.

PROJECT APPROACH:

Obj. 1. Dr. Seanna Annis accomplished our target of setting up the weather stations for mummy berry forecasting in the spring of 2012. The Specialty Crop Block Grant for this project provided funds for six weather stations to be purchased and delivered in March, 2012 together with 5 others purchased from other grant funds. In early April 2012, the weather stations were deployed in blueberry growers' fields around Maine from Appleton in Knox County to Meddybemps in northern Washington County. The weather stations performed well with some minor problems due to battery life and a cellular signal strength problem at one site. The stations did provide timely and accurate data to use for the forecasts. The weather stations were collected and stored over the winter and then re-deployed in April 2013. In 2013, the weather stations performed without problems, except for one station where minor adjustments had to be made to get a consistent cellular signal. Data from the stations were used for the mummy berry forecast. The data are also being used to determine if bloom and Botrytis blight forecast models from Nova Scotia and insect emergence models for Spotted Wing Drosophila and Blueberry Maggot Fly were suitable for Maine weather conditions.

Mummy berry plots to monitor fungal development were originally placed at most of the locations where weather stations were placed. In 2012, half and in 2013, $\frac{3}{4}$ of the plots germinated. In 2012 and 2013, seven growers cooperated with monitor mummy berry plots twice a week during the disease period. In 2012, there was a long period of possible infection and forecasts were provided for over one month and many growers had to make three applications of fungicide. In 2013, there was dry weather and no infection periods were detected earlier in the season. As the end of the period the mummy berry apothecia were present, there were a series of infection periods. In contrast to the previous year, growers only had to apply fungicide once to get excellent control of mummy berry disease in 2013. The forecast provided better information to allow growers to make more timely applications of fungicide and only the ones that are necessary. Throughout the disease risk season from early April to mid-May, we provided forecast reports on mummy berry disease, as well as, reporting the occurrence of frost for most of the blueberry growing areas. The forecast reports were delivered in three ways;

1. In messages sent out to an email list,
2. Posted on the Wild Blueberry extension blog (<http://mainewildblueberries.blogspot.com/>) and
3. Recorded as answering machine messages.

Obj. 2: Investigating additional control materials to build fungicide resistance management into the mummy berry IPM system.

We tested 4 fungicides for mummy berry control at two field sites with histories of mummy berry disease in 2012 and 2013. The standard fungicides , fenbuconazole (Indar) and propiconazole (Tilt),

were compared to fungicides with different modes of action (penthiopyrad; Fontelis), different chemistries (metaconazole; Quash, prothioconazole (Proline) or mixtures with fungicides with different mode of action (azoxystrobin and propiconazole; Quilt Xcel). We timed application of the fungicides with the MBFS and applied fungicides accordingly. In 2012, this was three times from April to May and in 2013, it was one application in May. Large growers in the state cooperated by allowing us to set up our fungicide trials on their land.

In 2012, all fungicides provided a significant reduction in mummy berry disease compared to the untreated check at both sites. The levels of disease recorded were 22.5% of diseased stems at one field, and 15.9% at the other for the check plots and ranging from 0.4 to 4.9% for the treated plots. This was unexpected since there were 12 possible infection periods which is higher than many previous years. Weather conditions of heavy rain and winds after the last fungicide application may have caused diseased leaves to fall off resulting in the lower detection of disease. Many of the symptoms found during rating were of leaves just starting to show infection. In 2013, we had few infection periods and very low disease levels. In one field where the check plots had 8% of infected stems, the fungicide treatments produced a significant decrease in the level of disease. In the other field, there was a very low level of disease (1 to 5%), and none of the treatments were significantly different from the check. These trials were successful in identifying a material with a different mode of action, Fontelis (penthiopyrad) that controls mummy berry disease and can be used in rotation with other fungicides to decrease the risk of fungicide resistance developing in the fungus that causes mummy berry disease.

Obj. 3: Testing fungicides for their effectiveness to control a new disease to Maine, *Valdensinia* leaf spot.

We ran into serious problems with the *Valdensinia* fungicide trial in both 2012 and 2013 because we were not able to obtain any suitable fields to conduct the experiment. Fields needed to have enough disease in large enough areas to allow the setup of replicated plots. Growers who previously had disease in their fields found very little disease in 2011 and when approached to set up our fungicide trial in the spring of 2012 reported low level and very small patches of disease. We discovered that some of these low levels of disease were due to drier weather conditions in June and July in 2011 which slowed the progress of the disease. Some of the fields we visited in the summer of 2012 did have significant disease problems but only in patchy areas. In July and August 2013, we found some new fields with larger areas of disease which may be suitable for future trials. The fungicide trials would need to be performed in June to July for effectiveness in decreasing levels of the disease.

GOALS AND OUTCOMES ACHIEVED:

The goal for **objective 1**, implement an IPM forecasting system for mummy berry blight, was to increase the number of growers using the mummy berry forecast system. For the last two years we

have provided forecast with improved information for areas not adequately covered before and have increased the education of the growers about the forecast with presentations at March growers meetings (about 150 attend), the July field day (200 attend) and April and May twilight scouting meetings. A survey conducted in March of 2011 found that 65% of growers (90 of 139 surveyed) had heard of the forecast and 47% of them (65 growers) had used it. The goal was to increase the number of growers using the forecast method to at least 60% . We surveyed growers at the blueberry school meetings in Waldoboro, Ellsworth and Machias after one season of use of the weather stations and the improved forecast. In surveys of the 134 growers who attended meetings, 81% said they use fungicides to control mummy berry disease and 67% said they used the MBFS to time their fungicide applications. In the above survey, it was also found that 28% of growers had tried setting up their own mummy berry plots which is a big improvement from only 5% in 2011 who had tried. Monitoring a mummy berry plot is a key piece of the forecast for a grower so it is encouraging that more growers are attempting it. Anecdotally, word of the weather stations and the forecast is spreading by word of mouth through the grower population. We will survey growers again in at future spring and field meetings to see if after two years of improved forecasts more growers are using the forecast system, what effect the information had on their use of fungicides, and if they are monitoring their fields for fungal and plant development.

Objective 2 is to develop reduced risk fungicide options to help manage resistance to controls and provide “softer” control options. Our goal was to test 10 lower risk fungicides over two years for their effectiveness in controlling mummy berry blight and identify at least 1 alternative for control of this disease. Of the surveyed growers who use fungicides to control mummy berry disease, 88% said they use propiconazole. Only less than 5% of growers used other fungicides. There currently are two fungicides mainly used to control mummy berry blight. We tested 5 new materials for their efficacy in controlling mummy berry disease. One of the materials, Fontelis, has a different mode of action than what is currently used and was effective over two years of trials and will be recommended to growers. We did not accomplish our goal of testing 10 different materials largely because we over-estimated the number of new fungicides that would be available for trials.

The third objective is to determine the effectiveness of fungicides to control *Valdensinia* leaf spot since currently there are no fungicides labeled in the USA for control of this potential devastating disease. The goal is to identify at least one fungicide that is effective and provide information for getting at least one fungicide labeled for control of this disease on lowbush blueberries. We did not accomplish this goal due to a lack of a suitable field site. We are fortunate that *Valdensinia* leaf spot has not become wide spread in Maine. If a suitable site becomes available, we will try to set up a fungicide trial in Maine. Work has been done on fungicide treatments in Nova Scotia where the disease is widespread. One material, Pristine, that has been found to be effective against *Valdensinia* leaf spot in Nova Scotia trials has been registered for this disease on blueberries in the USA in the last two years.

BENEFICIARIES

All growers who use organic or conventional fungicides to control mummy berry blight can benefit from the mummy berry forecast. All growers and the public will benefit since the MBFS can produce equivalent or improved disease control with fewer, better-timed applications. In the 2012, a long wet spring necessitated some growers making three applications of fungicides, but in 2013, with drier weather only one fungicide application was recommended using the forecast system and this provided excellent control for the growers. Additional environmental benefits will also accrue with fewer fungicide applications necessary to control this disease. In applying one less application, a grower can save \$20 per acre which is significant to owners of small, medium and larger fields. There are approximately 575 blueberry growers in Maine and from the survey mentioned above approximately 81% (480 growers) can be estimated to use fungicides to control mummy berry blight. The identification of new fungicides with different modes of action and lower risk for control of mummy berry disease will benefit the same number (480) of growers who use fungicides to control mummy berry disease. Yield losses are typically from 24 to 79% without adequate control, however sometimes damage to the plants is so extensive growers will not bother to harvest a field at all resulting in 100% loss. Without effective control, the average yield loss due to mummy berry blight is estimated to cost the blueberry industry \$41 million a year.

As of 2013, *Valdensinia* leaf spot has only been found in 19 commercial blueberry fields and 7 other blueberry patches in Maine, but has a large potential to spread among wild blueberry fields by movement of infected leaves. Many owners of small acreages contract with larger growers to manage or harvest their fields and equipment is used and moved among multiple fields in a season. This disease has the potential to affect all 575 blueberry growers in Maine (USDA 2007 Ag Census). Yield losses of up to 60% have been reported in Nova Scotia.

LESSONS LEARNED

If you provide quality information and education, you can effect a change in grower attitudes. In 2007 very few growers were using the mummy berry forecast to time their fungicide applications and most were not getting adequate control of this disease despite applying at least two applications of fungicide a season. We now have an estimated 67% of growers using the forecast method and control of this disease is reported to be better by most of the growers.

Another lesson learned is to not overestimate either through optimism or pessimism. We optimistically over-estimated the number of fungicides that would be available for testing for mummy berry control. We pessimistically over-estimated the level of *Valdensinia* leaf spot disease we would find. Due to the lack of a sufficiently sized area infected with *Valdensinia* leaf spot disease we were not able to complete one of our objectives to test fungicides for control. The size of the diseased areas are still small enough that our recommendation to growers is to burn all of the leaf litter to eradicate the fungus from the field. This has been very effective in most fields with the disease and we hope to keep the level of this disease at a minimum.

CONTACT PERSON

Patricia Kontur, Director of Programs

207-581-1475

Pkontu71@maine.edu

Dr. Seanna Annis, Principal Investigator

207-581-2621

sannis@maine.edu

Project 6: Development and Implementation of a Wild Blueberry Thrips Integrated Pest Management Program for Maine's 575 Growers

Final Report

Project Summary: This project was a two-year research and extension/outreach project designed to enhance integrated pest management of blueberry thrips, a significant insect pest of wild blueberry in Maine. Research resulted in the development of three field validated management tactics for thrips control. The first tactic relies upon a non-insecticide cultural control by burning or mowing infested stems during the vegetative crop year. The second tactic relies upon timing of select (efficacious) insecticides during stem emergence in the prune year and the third tactic can be used if the stem emergence timing is missed, a post-infestation treatment with systemic insecticides. Although the third tactic is not efficient it does allow a tactic that can be used in the emergency case of an unnoticed infestation late in the season. Surveys were used at the start and at the end of this project to evaluate grower learning and acceptance of IPM projects and Extension /outreach presentations at grower field days were used to train growers in the application of these IPM tactics.

Project Approach: The approach involved both field research, grower survey, and extension presentations. The objectives that comprised the approach are as follows:

Objective 1: Develop and deliver an integrated pest management (IPM) program for thrips control by wild blueberry growers in Maine.

This objective included:

- a) the integration of monitoring and sampling methods to establish the extent of infestations and proper timing of control tactics;
- b) integration by growers of cultural and insecticide control tactics; and prior to the development of the integrated pest management plan, two large scale commercial field trials will determine the efficacy of novel control tactics to managing blueberry thrips that have been shown to be promising from multiple years of small scale experimental plot experiments.

Objective 2: Communicate the pest management strategy to wild blueberry growers in Maine, evaluate adoption of this new production practice among growers, and identify any impediments to adoption.

This objective included an extension/outreach program to train growers in both a formal classroom environment and in the field during twilight meetings in growers' fields. In addition,

- 1) two surveys will be conducted to assess improvement in understanding of thrips biology and management by growers over the course of this proposed project and
- 2) a case study of three growers will be conducted in order to identify levels of adoption of thrips integrated pest management and possible barriers to adoption.

Goals and Outcomes Achieved: All of our objectives were met. The results of our research was integrated into an overall IPM program for blueberry thrips. This program is outlined in our Maine thrips management fact sheet is currently available to wild blueberry growers both as a hard copy (available from Dr. David Yarborough, University of Maine Cooperative Extension) and an electronic download from the University of Maine Cooperative Extension Wild Blueberry Web page [file://localhost/\(http://umaine.edu/blueberries/factsheets/insects/202-blueberry-thrips:\)](file://localhost/(http://umaine.edu/blueberries/factsheets/insects/202-blueberry-thrips:)).

The detailed timeline of our accomplishments are below:

- 1) presentation of the results for 2012, included in this report, to the Wild Blueberry Advisory Committee (WBAC): *November 2012* - **COMPLETED**
- 2) construction of an IPM thrips program...already complete: AHEAD of Dec 31, 2012 deadline. **COMPLETED**
- 3) factsheet development and publication: *March 2013* **COMPLETED (see below)*****
- 4) development of a Powerpoint® presentation for the 2013 blueberry school:
March 2013 – delayed due to the priority of concentrating on the spotted wing drosophila invasion – May 2014 COMPLETED, except the talk was given in the field instead of a Powerpoint presentation. The talk was given at three locations: Waldoboro, Jonesboro, and Orland, Maine.
- 5) twilight meetings to present IPM program to growers in the field: April – July 2013 **COMPLETED**
- 6) summer field day presentation: July 2013 **COMPLETED**
- 7) second grower survey: August – November 2013 **COMPLETED**
- 8) second annual report to Maine Department of Agriculture: Sept 30, 2013 **COMPLETED**
- 9) update on progress to the Wild Blueberry Advisory Committee (WBAC): *November 2013* **COMPLETED**
- 10) grower case study interviews: May 2014, **COMPLETED**
- 11) analysis of second survey: May 2014, **COMPLETED**
- 12) final report to Maine Department of Agriculture: October 31, 2014 **COMPLETED**

Beneficiaries: The Maine wild blueberry grower community was the identified stakeholder in this project. There are approximately 450-500 Maine wild blueberry growers. This group farms mostly in Washington County (ca. 70%). The median age is about 60 years old and about 30% are full-time growers. Most growers are conventionally based growers that practice IPM (80%) and almost 20% are organic. Eighty percent of the growers are male, but 40% farm with a spouse. Most of the growers are white, although the Passamaquoddy tribe owns and farms a substantial amount of land (ca. 2,000 acres). Rose et al. (2010) describes in much more detail the Maine wild blueberry grower target audience.

Lessons Learned: A major lesson learned during this project was that production priorities can change quickly. During this project an invasion of a new pest, the spotted wing drosophila (SWD), occurred and suddenly, thrips management was a minor concern and SWD management was the focus of all IPM efforts. The urgency to develop IPM programs for the spotted wing drosophila have lowered the priority of the grower case study publication. However, the most significant accomplishments have been completed and have resulted in a multi-faceted IPM strategy for

controlling blueberry thrips and a Factsheet has been published and is uploaded to the University of Maine wild blueberry website so that all growers in the state have current recommendations for this pest's management.

Contact Person: Dr. Francis A. Drummond, School of Biology and Ecology and Cooperative Extension, University of Maine, 305 Deering Hall, Orono, ME 04469, phone: (207) 581-2989, email: frank.drummond@umit.maine.edu

Additional Information: an objective NOT in the proposal, but a project that I decided to take on is to develop a publication of grower case studies involving management of blueberry thrips. This non-funded project is currently DELAYED *until the spring of 2015*.