

Maine Department of Agriculture, Conservation and Forestry

Specialty Crop Block Grant
2014- 2017
Program
Maine State Plan

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Project Coordinator

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Organization

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Outreach Plan

Outreach to Socially Disadvantaged and Beginning Farmers

The Department collects and maintains an email list of all farmers and organizations who want to get copies of any grant program announcements. This includes some SDBF's organizations. In addition, the Department added to the list all of the specialty crop agricultural organizations that may have an interest in this program. Outreach was performed to all identified specialty crop producers and organizations in March, 2014, including groups representing disadvantaged farmers and new farmers.

The following projects address socially disadvantaged and/or beginning farmers:

Project Title: Supporting Maine Specialty Crop Producers with Food Safety Audit Preparation - # 1 in scoring grid. Page 8 in Narrative.

- **Workplan assumes 30 farms will receive audits. ~10 are likely to be “Underserved “ farmers**
- **Workplan outreach will likely reach ~200 “Underserved” farmers**

Project Title: Increasing the Nutrition Knowledge and Consumption of Specialty Crops by Maine Children and Adults - # 8 in scoring grid. Page 18 in Narrative.

- **Workplan assumes 7,000 students 44.5% of whom qualify for free and reduced lunch. Therefore ~3,115 “underserved” school age children will be affected.**
- **Dept can extrapolate that nearly as many underserved families will indirectly benefit from the education of at least one family member.**

Project Title: Improving Maine Potato Yields through Increased Rotation Lengths and Improved Crop Rotation Crop Profitability. #10 in scoring grid. Page 32 in Narrative And

Project Title: Main Potato Integrated Pest Management. #11 in scoring grid. Page 41 in Narrative.

- **Workplans assume 300-400 potato farms will directly benefit, ~90-120 of which are likely to be “Underserved” farmers.**

Project Title: Increasing Food Safety Margin of Wild Blueberries through Improved Intervention Measures. #15 in scoring grid. Page 72 in Narrative.

And

Project Title: Improving Integrated Pest Management for Maine Wild Blueberry Growers . #16 in scoring grid. Page 84 in Narrative.

- **Workplan assumes contact with 510 farms, of which 153 are likely to be “Underserved” farms.**

Project Title: Enhancing the Competitiveness of New England Specialty Crops through Regional Collaboration. # 13 in scoring grid. Page 54 in Narrative.

- **Workplan assumes 33 scholarships, of which 11 are likely to be to “Underserved” farmers.**

Outreach to Specialty Crop Stakeholders to Identify Funding Priorities

The Department went with the same priorities this year as last with the exception of adding Food Safety research along with education, as a number of the projects funded last year were ongoing and were expected to reapply to the program this year. These priorities were **established by the Commissioner of Agriculture, Conservation and Forestry with input from Department of Agriculture Leaders and Industry:**

1. Any proposal from the previous year which was for a multiple year term and was only funded for the first year of the project. For those projects that fit under this category, they must show progress from the first year’s funding in the workplan section of the proposal.
2. Enhancing food safety research and education, primarily in relation to new FDA rules regarding improved handling and processing specialty crops.
3. Enhancing integrated pest management research and education for programs for specialty crops.
4. Research and Demonstration of alternative methods of harvesting specialty crops.
5. Increase in child and adult nutrition knowledge and consumption of Specialty Crops.

In addition, informal discussions with agricultural leaders showed that the highest priorities continued to be insect and disease management as well as food safety.

Competitive Process

The State of Maine's formal RFP process was utilized to generate project proposals and to evaluate and score the submissions. Notification of the RFP was done through the State mandated channel of public notice in the statewide print media for three consecutive days. In addition, copies of the RFP opportunity were sent directly to those agencies/nonprofits that had been identified as representing specialty crop farmers and to numerous agricultural organizations, non-profit groups, and individuals who expressed interest in getting an RFP. A list of those who received the RFP is available.

Eighteen (18) proposals were received. A confidential review panel of four individuals scored the submissions in keeping with state practices. The review panel was made up of a member of the legislature with interest in natural resources and agriculture, a dairy farmer associated with the Statewide Farm Bureau with knowledge of a lot of the commodity issues, the Deputy Commissioner who has a broad understanding of many of the specialty crop industries having served as head of the State FSA for many years, and the Bureau Director who has direct oversight of all of the State's agricultural industry sectors. The review panel was asked to sign standard State "Conflict of Interest" forms as additional control over the process and those forms are available upon request. The Director for Market Development facilitated the selection process. None of the committee had direct connection to the specialty crop industry proposals. The scoring was accomplished by consensus, as required by the Division of Purchases. The results of the scores of the peer review panel were compiled and the results were made available for the Commissioner to put into the State Plan. The results of the scores were also made available to any applicant who had a concern about the process. By way of openness of state government, all information regarding scores, including comments by the reviewers, and the reviewers' names and affiliations were made available to any applicants who were considering filing appeals. No appeals were received this year.

State Department of Agriculture Oversight

For Grant period October 2014 to September 2017, the Maine Department of Agriculture, Conservation and Forestry did not submit any project proposals on its own behalf. All Specialty Crop Block Grant Funds will be used to fund projects submitted through the RFP process with the exception of 8% of the funds that will be retained by the agency for indirect costs.

We expect to have indirect charges applied at 8% for all USDA grants, for a total of \$44,469.88. These charges will include project oversight, annual and final report preparation, and accounting services. We have a close working relationship with the organizations and communicate with them frequently about their projects. A typical oversight for these projects is to complete an initial meeting with the project managers, develop formal contracts, and establish

when the projects will begin. The Department then monitors progress through informal meetings and attending of workshops that may be given on the program. We also monitor through the Subcontractors filing of invoices for work accomplished as the project progresses. At annual reporting time we collect the information from the project coordinators of the work performed and review the report with the subcontractor. The Department then prepares and files these reports to USDA. We use the same process for filing of the final reports.

Section II
Project Title:
Supporting Maine Specialty Crop Producers with Food Safety Audit Preparation

Abstract:

In order to maintain and/or grow their markets, many Maine Specialty Crop Producers need to successfully be annually audited for Food Safety with GAP/GHP; Produce GAP's Harmonized; or other third party audits. Growers need and want assistance preparing for these audits.

AgMatters LLC will hold group meetings and one-on-one meetings with growers in order to assist with this transition of audit expectations. We have many years of experience working with The Maine Vegetable and Small Fruit Growers Association and the Maine Pomological Society promoting food safety with specialty crop growers and markets in Maine. Some Maine food hubs are beginning to ask for this certification as well. We respect the individuality of Maine farms and wish to assist with the creation of plans that reflect realistic practices. It takes a great deal of time, effort and investment for growers to meet these expectations. This grant will enable AgMatters LLC to assist a minimum of 30 specialty crop growers as they tackle the Food Safety Audits that their markets demand. Success will be measured by the number of growers who are assisted with audit preparation and their feedback.

Project Partner Organization

AgMatters LLC will establish an agreement or contractual agreement with the State Department of Agriculture to lead and execute this project.

Section III
Project Purpose

The purpose of this proposal is to assist Maine specialty crop growers as they undertake the task of preparing for various food safety certifications for their produce operations that are demanded by their markets. This is a proposal for a third year of this project and it is being proposed as a 2/5ths position. The previous two years were for a full-time position. The thinking behind this is that the materials needed to accomplish this work have already been created by AgMatters LLC. There are no changes to the audit process being proposed for the coming year. AgMatters LLC feels that the one on one assistance to growers will be able to be met by this proposed part-time position. This project will begin on October 1, 2014 and end on September 30, 2015.

The objectives of this project address the following issues identified by USDA and the Maine Department of Agriculture, Conservation, and Forestry:

- **It is all about “Developing Good Agricultural Practices”, “Good Handling Practices”, and “Good Manufacturing Practices” for small farmers, packers and processors.**
- **It “enhances food safety education, primarily in relation to the new FDA rules regarding improved handling and processing of specialty crops.**
- **This grant has been funded for two years. We would like to extend it, part-time, for another year.**

We field calls and meet with growers all year long. We work with markets and with entities such as Maine Vegetable and Small Fruit Growers Association, the Maine State Pomological Society, Maine Sustainable Agriculture Association, the Maine Wild Blueberry Association, MOFGA and Cooperative Extension with food safety.

We have worked with over 80 growers already in the last two years of this grant. We met with Hannaford to help them understand GAP/GHP; Harmonize GAP; and the anticipated implications of FSMA on growers. We have met with representatives from MOFGA about how to assist growers with preparations for implementation of FSMA.

We have asked for and received evaluations from growers we have worked with since September 2012. We have listed typical comments below:

- “We found out we were already ahead of the curve, which reinforced what we were already doing and gave us ideas how to improve our safety program in general. Our biggest change was in our documentation and organization of such.”
- “The support provided by AgMatters is critically important to farms such as ours.”
- “We implemented many of the recommendations, but have not felt the need for an audit.”
- “Food Safety certification has allowed me to maintain my sales.”
- “AgMatters LLC assistance made the difference.”
- “Without outside support, it would be impossible for a small owner-operator to stay current in the rapidly changing (ever increasing) regulatory arena.”

The role of AgMatters LLC is to assist with audit preparation, but also to educate growers about good agricultural practices as they continue to emerge. (FSMA) We collate information and provide growers with menus of options for specific situations they face. We also work with markets so that we have a good understanding of what is expected of growers, and to make sure that the markets have a good understanding of what they are expecting of growers and the impact of those expectations.

FSMA will release its revised Produce Safety Rules in the summer of 2014. Their impact will not be felt directly by farmers for several years, however it is important that growers become aware of them and make comment during the comment period. AgMatters LLC will share this information as it becomes available to its distribution list of 114 GAP/GHP auditees.

AgMatters LLC will keep growers aware of upcoming changes in Food Safety as they occur.

This grant is about educating growers about those changes, as well as helping them to be successful in their specific Food Safety audit. Growers may not be aware that there are options otherwise. Preparing for an audit is an intimidating process. We all like to think we are doing things right and may feel resentful of criticism or proposals of change. Add to that the fact that most Maine vegetable and fruit farms may have 1 or 2 full time employees and a few extra part-time people at harvest and that they are busy all the waking hours of the day. Preparing for and living with the rules and regulations of an audit can be a full time job in itself to effectively implement on some farms. The good news is that many growers have already been through a GAP audit. We believe that GAP is the most basic audit out there. It has provided a basis that all other audits have built on.

AgMatters LLC cannot stress enough the importance of one-on-one meetings with growers in order to help them prepare for their audits. Group meetings are fine for general training but not for fine-tuning a Food Safety Plan. One must remember that farming is a competitive business. Each farm is unique and does things a little differently; we believe our job is to enable growers to maintain their uniqueness within the confines of audit expectations.

Produce GAPs Harmonized has all the expectations that GAP/GHP has, and a lot more. It requires someone to be in charge of food safety 24/7. It requires a disciplinary policy for violations by employees. It requires a formal food safety course or workshop. One must document corrective action procedures for any non-conformance with food safety and track them over several years. It requires self-audits, it looks critically at possible risks associated with land history, adjacent land use, including buildings and equipment. It requires things that were optional with GAP/GHP. If farm employees need to wear protective clothing, they will have to be stored, worn, and cleaned according to set policies. Each employee will need to have his/her own designated storage spot. Growers will have to have policies about jewelry, nails, hair coverings and the like. Water systems will have to be described and drawn to show where the water sources are, where permanent fixtures are, the flow of the system, and the location of gates, wells, reservoirs, returns, backflow protection, etc. Risk assessments will need to be made of the system, as well as monitoring and verification procedures, monitoring, and corrective actions. This will require training. It will require monitoring of chemical application logs by auditors to show that they have been applied correctly, applied at the correct temperature and appropriate rate. This includes chemicals applied pre-harvest and post-harvest-- like biocides, waxes, and plant protection products. It will also require a list of all soil amendments applied to the soil to ensure they have been applied correctly.

This is an important, but complex process, especially for the small farmer. It is viewed at first as an impossible hoop they must jump through. AgMatters LLC has worked with growers in this capacity for the last six years through Specialty Crop Grants. Each farm is different. Each audit is product specific. Some growers need a lot of assistance, and others just need assurance that what they are doing is acceptable. AgMatters LLC must prove to the growers that they can do what is expected of them as part of their certification.

AgMatters LLC, in one concentrated one-on-one working session, helps growers develop a Food Safety Plan they can honestly implement. When someone has taken the organizational steps to simplify such a process and make it doable, farmers are very grateful and willing to take the next steps. This is what we do. When we leave the farm after a work session about food safety, growers work is really just beginning. They have to implement all the protocols and trainings and testing and logging and prepare for their audit. AgMatters LLC continues to work with growers until their level of comfort with the process is second nature.

AgMatters LLC provides the technical assistance growers need, and works with them through issues involving manure, water, safety, hygiene, packing, storage, transportation, and traceback. We keep them abreast of the latest scientific data available from Food Safety studies and share ideas that others have tried. We bring together information such as how to write standard operating procedures for everything from mixing chlorine bleach or Oxidate for sanitization to

how to clean up after a blood contamination. We advise on things like how to most cost efficiently build a hand washing station; how to cost effectively attempt to keep animals out of production fields; how to train employees; where to get materials for Worker Protection training; how an outhouse can be considered a “legal” restroom facility, the list is endless.

Maine farms are unique. Food Safety plans reflect that. One farm may use city water, another not have any water at all. Some have animals which need to be taken into consideration when making a plan. There are common Standard Operating Procedures for things like blood, plastic, glass, chemicals and contaminants. But there are others that are needed because one farm may either be sanitizing differently than another, or are washing product that is affected by the temperature and pH of the wash water. Food Safety audits are about being prepared (in writing) for any eventuality, from a flood to a recall of product.

The breadth of our experiences with food safety and agriculture is an integral part of why we are successful in this work. We are able to ask questions and get answers that would be difficult for any one individual to do, simply because of the links we have made over time. The position we are in is non-threatening. We are not audit police nor are we the market police. We are only successful if the farm is successful. We are able to put issues into perspective and relate real stories that make everyone chuckle in order to make this a positive experience for all. Quite truthfully, no one goes through this process without learning something. (And that includes us).

Each year more people come on board the food safety wagon. We take calls or emails all year long about “What should I be doing now?” or “I have to get certified, and I don’t know where to start.” We have the answers to these and other questions or we get them. We make great efforts to share tips we have gleaned from this process with everyone. We often get phone calls from other states and are happy to talk and send the information they need.

Audits must be repeated every year. Some people choose to certify different crops, each time impacting their Food Safety Plans. Audits themselves also change or are updated. Produce GAP’s Harmonized Audit did not exist in Maine two years ago. We get calls for help with other third party audits as well. At this time in Maine, several markets accept GAP.

AgMatters LLC has created a template for Food Safety Plans for several of the audits currently used in Maine. We continue to update them as changes occur in the industry. We share this information with our ever increasing email and snail mail directory of growers and on our web site. We are about making Food Safety do-able for all specialty crop farmers.

This project will increase the marketability, and raise the reputation of local produce and producers. It will allow farms to share with the public market the methods they employ to produce the best product they can. It will allow all growers to work towards common standards and use that information to better inform the public of what it is they do to earn that certification. This project gives farmers the assistance they need to implement Food Safety Practices demanded in their audits in ways that they can live and work with and to do it with people that they trust (AgMatters LLC staff). This grant will not certify anyone, but it will provide guidance towards successful certification in non-threatening ways.

The work will involve publicizing the service through word of mouth, email, web sites, and handouts. AgMatters LLC will present at the Maine Vegetable and Small Fruit Growers and the Maine Pomological Society's Annual meetings at the Maine Agricultural Trade Show in Augusta in January of 2015. AgMatters LLC will guest speak at commodity group meetings, Farm Bureau meetings, or other group meetings. Most of the work will be done with one on one meetings with farmers at their farms. Phone calls, emails, and snail mail and our internet site will support the process.

This project differs from the previous two years grants because it is now part-time (2/5th FTE), rather than full time. It allows the support to continue, but at a less intense level. The likelihood that this project will become self-sustaining and not indefinitely dependent on grant funds is highly unlikely. There are not enough growers in Maine with the capital to hire this type of assistance. The focus of these grants has been on support for small farms.

This grant has the support of the Maine Vegetable and Small Fruit Association and The Maine State Pomological Society. Letters of support from each group are attached. This project builds on previous Specialty Crop Grants. The first, RFP200811324 in 2008 and 2009, allowed AgMatters LLC to provide Technical Assistance to Specialty Crop Growers. The second, RFP200906474, from 2009-2012 allowed AgMatters LLC to Support Specialty Crop Growers through GAP Certification Preparation. The last, Supporting Maine Specialty Crop Producers with Good Agricultural Practice and Good Handling Practice (GAP/GHP) Audit Preparation; Produce GAP's Harmonized Audit Preparation, and Assistance With Other Third Party Food Safety Audits was funded 9/2012 to 9/2014. We would like to extend this grant into year 3 (2015) on a part-time basis.

Hannaford and Shaw's currently require GAP/GHP certification of their growers; however other markets demand other options. Some Maine food hubs and distributors are moving in this direction as well. This grant allows AgMatters LLC to invest time and energy in assisting growers to meet the requirements of Harmonized GAPs; or other third party audits-- such as Global GAP and GSFI recognized programs such as SQF 1000, as well as assist GAP/GHP auditees.

This grant will not be funded by another Federal or State grant program. It does not duplicate the efforts of the SCBGP-FB nor does it duplicate efforts by any other Federal or State grant program. It supports Maine's Specialty Crop growers as they transition to the expectations of the consumer world. It builds on three previous Specialty Crop Block Grants and takes the next steps needed to ensure that all growers are given the knowledge and opportunity to be successful marketers.

Section IV **Potential Impact:**

The intended beneficiaries of this grant are over 30 Maine Specialty Crop growers. They will receive assistance from AgMatters LLC as they prepare for their food safety audits with audit preparation assistance, food safety training, and updates about what is going on

in the world of food safety. Food Safety Audits MUST be renewed annually.

Food Safety is a commitment; it is a scientific, thoughtful, and intentional way of doing business. It is based on preventative action. It cannot guarantee food safety; it can only show that the grower took preventive action in order to produce the safest product possible. Food Safety training opens doors of communication on every farm by establishing a common language and standards that did not exist before.

With the Food Safety Modernization Act Produce Safety Rule and the Proposed Rules for Preventive Controls for Human Food soon to become law, some markets are already preparing to require their growers to acquire the more difficult Harmonize GAP certification, instead of GAP/GHP. Here in Maine, Hannaford and McCain's are two such markets. This is further evidence that even though the government may not require it of smaller growers, their markets will.

Growers appreciate the assistance and the ability to call with questions. Growers we have worked with have told us they could never have undertaken the job alone. Our focus is to share the information, but also to make the process do-able. Small growers cannot do their job of growing product and take on a complicated process for food safety. We help to simplify the process, yet maintain the integrity of food safety issues and the audit. For one audit, we downsized all the logs that needed to be kept on a regular basis (about 20 different items) into one log. We trained growers to sit down at the same time every week, maybe at coffee time on Monday, and fill in the log for the past week in order to accurately maintain their logs. If a grower wants to keep 20 different logs instead, they can. But that much paperwork can be overwhelming. We can and have simplified process. Suddenly the task is not so overwhelming. We can help growers figure out exactly what they need Standard Operating Procedures for given their individual operations or advise them on how to deal with staff that are used to eating in the fields or not washing their hands before handling produce. When we have spent time with a grower, going over the process, the most common response is, "Is that it? I think I can handle this!" or "I already do most of this stuff, I just never wrote it down before."

The impact of this grant will be felt by consumers of local foods in Maine. Audited farms will have taken all precautionary steps advised by food safety materials and demanded by GAP/GHP and Produce GAP's Harmonized audits and other audits so as to produce the safest food they can.

This project will improve and enhance competitiveness for specialty crops in Maine. These certifications are all about meeting standards that apply no matter what the size of the operation. It allows all farms to compete on the same playing field, as they attain levels of certification that are well respected throughout the states. Food Safety Certification is something worth bragging about. It stands for extra efforts made by individual farmers to insure that their products are of the highest quality. Although certification is not a guarantee of food safety, it is proof that the farm is doing all it can to produce the highest quality produce in the safest way they can. These certifications open doors to new markets for growers, if they are interested in growing.

The potential economic impact of this project is the ability for growers to sell product to

larger markets, hospitals, and schools, as well as maintain their current markets. Many grower’s markets have demanded that they receive specific Food Safety certification. For these growers, failure to do so may terminate their ability to make a living farming. For growers who would like to grow their business, these audits open opportunities to compete in the larger market.

Markets must focus on Food Safety in order to stay in business. Contamination issues are reported in the news almost daily.

Growers will have to identify and prioritize their areas of focus. Are they interested in growing their business? How much do they want to grow? Do they want to grow in volume? What unique niches can they fill? In the last few years, we have watched this happen on a grand scale. Several of the first farms audited have grown exponentially. Many have added packing houses, or added value added preparation of some crops, or are growing specialty items that never would have moved in their other markets. They have added delivery trucks and taken a great deal of pride in this growth. Others have been quite happy to maintain status quo. Whatever the economic choices made by individual farms, they have become more aware of their Food Safety practices and implemented strategies to insure they are following their protocols.

AgMatters LLC has worked with growers from other New England states in the past who wanted to participate in this type of education. All growers are invited to participate in this programming at Maine venues and that policy will continue with this grant.

Section V
Expected Measurable Outcomes:

Project Goal	Outputs	Output Performance Measure	Outcomes/ Targets	Outcome Performance Measure	Long-term Impacts
To assist at least 30 Maine Specialty Crop Growers prepare for a GAP/GHP audit or a Produce GAPs Harmonized audit.	*At least 30 Specialty Crop Growers will receive materials needed and one on one assistance as they prepare for a successful GAP/GHP or Produce GAPs Harmonized audit.	*Number of participants worked with *Number of successful audits conducted in Maine from Oct. 1, 2014 through September 30, 2015. * Evaluation data will be used to make improvements to the program.	*All participants will report that the assistance provided by AgMatters LLC either made the process simpler and more streamlined .	*At least 30 growers who received this assistance will have successful audits as a result of this tutelage. This data is available	Maine farmers will develop a process for preparing for their food safety audits, thus encouraging them to repeat the process in future years. This makes them eligible for selling their produce to major markets.

				on the USDA website and from Maine's auditors and will be reported in the final report.	
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- A minimum of **30** growers who participate with this grant will receive assistance preparing for Food Safety audits such as GAP/GHP, Produce GAP's Harmonized Audits, This will include recertification, new certification, or increased certification levels for these farms.
Outcome: A list of participants for the grant and a list of certifications earned during the year will be maintained by AgMatters LLC.
- The one on one grower work will continue to evolve and improve, based on grower feedback.
Outcome: Evaluations will be given to each grower. Resulting criticism and suggestions will be studied and incorporated into the program. Results will be saved and summarized so they can be reported in the grant final report.
- AgMatters LLC will hold a large group meeting at the Maine Agricultural Show in January, 2015.
Outcome: Numbers of attendees will be kept.
- AgMatters LLC will speak to at least three other grower meetings during the year, sharing information about the grant and encouraging others to undertake a Food Safety Audit.
Outcome: Records will be kept of all speaking engagements, as well as numbers in the audience.
- Materials put together by AgMatters LLC to assist growers with this process will be shared on their website (www.agmattersllc.com) and updates will be sent out in regular email notifications to growers on a regular basis.
Outcome: A summary of these materials will be made in the final report. AgMatters LLC will share the results of this grant with the MVSFGA and the Maine Pomological Society's annual meetings held at the Maine Agricultural Trade Show held in January of each year.

This one year project will begin on October 1, 2014 and end on September 30, 2015.

Project Timeline

October 1, 2014-January 1, 2015

- Prepare audit assistance materials for distribution at major events

- Update Food Safety Plan template as necessary.
- Prepare hard copies of materials to assist auditees and post them on the web site
- Talk with major markets to clarify audit expectations they have for growers.
- Communicate with and research materials and information needed for third party audit certification.
- Talk with Maine State-Federal Inspectors for updates of GAP/GHP and on Produce GAPs Harmonized.
- Prepare evaluations for growers so that they can send them back to us after our work with them is complete.
- Update AgMatters LLC website materials with Food Safety materials.
- Make growers aware of new Produce Safety Rule proposals that should be released in the summer of 2014.

January 2015

- Prepare and Organize for Food Safety Certification Preparation meetings at the Agricultural Trade Show held in January.
- Hold a large group meeting at the Maine Agricultural Trade Show to share the latest information regarding Food Safety.

October 2014-September 2015

- Work with farmers who are recertifying, certifying for the first time, or expanding their certification using phone, email, snail mail and one on one visits.
- Collect evaluation data, incorporate suggested changes. Compile data for annual reports.
- Continue to inform growers of developments in the field of food safety via email distribution list web page, and some snail mail.
- Provide outreach to Small Fruit and Vegetable Growers, Maine Pomological Society and the Maine Wild Blueberry Growers, Maine Potato Growers, and other groups at their various group meeting sites.
- Visit farms, and meet one on one with farmers as they prepare their physical facilities for certification and begin the process of creating their own Food Safety Plans.
- Work with the auditors to clarify specific inquiries. Share information with farmers via email, snail mail, web site and phone.

September 2015

- Prepare and submit final report for this project.

Part VI
Work Plan

Activity	Responsibility	2014-2015
Prepare for and carry out a large-group Food Safety updates at MVSFGA and Maine Pomological meetings at the Agricultural Trade Show in Augusta in January 2014. These meetings will make growers aware that assistance with these audits is just a phone call away. They will also provide an opportunity for growers who have gone through the process to share their	Linda, Lauchlin,	January

experiences.		
Advertise this grant and update materials and posted them on www.agmattersllc.com web page or mention them on AgMatters LLC Facebook page.	Linda	Oct-Sept
AgMatters LLC will create or collect materials that will aid growers in their audit process.	Linda	Oct-Sept
AgMatters LLC will supply growers with materials and access to the latest information in Food Safety as it applies to their operations via emails, internet, or directly.	Linda	Oct-Sept
Individual work sessions will occur over the phone, via email, and/or by personal visit in order to get the farm ready to undertake these audits. Materials will always be available in hard copy, via email, or downloadable from our web page	Linda	Oct-Sept.
AgMatters LLC will speak at any agricultural meeting and prepare materials for dissemination in other's newsletters (Farm Bureau, MOFGA, Blueberry News...) about the grant.	Lauchlin Linda	Oct-Sept
AgMatters LLC will collect and utilize suggestions and criticisms received from evaluations throughout the grant term. These will be reported in final report.	Linda	Oct-Sept
AgMatters LLC will work with markets to ascertain their requirements of growers.	Lauchlin Linda	Oct-Sept
AgMatters LLC will work with GAP/GHP; Produce GAP's Harmonized; or another third party audits.	Linda Lauchlin	Oct-Sept
AgMatters LLC will work with individual farms and assist with implementation of their Food Safety Plan and in dealing with manure, water, fertilizer, safety and hygiene, packing house, storage, transportation and traceback issues.	Linda Lauchlin	Oct-Sept
AgMatters LLC will continue to update and educate themselves about food safety audits and issues by reading, working with Maine's State-Federal Inspectors, and making calls to experts in the field.	Linda Lauchlin	Oct-Sept
AgMatters LLC will read, study, and implement changes to program suggested by growers in their feedback.	Linda Lauchlin	Oct-Sept
AgMatters LLC will contact major markets for produce in Maine about their expectations for growers.	Lauchlin Linda	Oct-Sept
AgMatters LLC will complete the final report for this grant	Linda	Sept. 30

Section VII
Project Commitment

This project has the support of the Maine Vegetable and Small Fruit Growers Association, the Maine Pomological Society, Food Distribution Services such as Crown of Maine (Marada Cook), Farm Fresh Connection (Martha Putnam), and wholesalers like Hannaford Bros. amongst others. Specialty Crop growers support this work because they appreciate the assistance and

knowledge offered. Distribution Services support it because more of their buyers are asking for food certification and there is no easy way to get them this assistance otherwise.

AgMatters LLC is a Maine family agricultural consulting business that has worked in the area of Food Safety, GAP/GHP Certification, and Nutrient Management through Specialty Crop Grants for the last 6 years. AgMatters LLC is well known in the field of Agriculture in the State of Maine. It has connections to all vegetable and small fruit growers in the State, as well as experience in the fields of agricultural consulting and nutrient management. AgMatter’s mission is to provide information and services that help Maine Farmers increase productivity, quality, and profitability of their farm operations; thereby enhancing the quality of life for farm families; the communities in which they operate, and the environment of the State of Maine. This experience, coupled with great pride, respect, and a commitment to the success of Maine Agriculture, make AgMatters LLC the best choice for this work.

Section VIII
Budget /Budget Narrative

6. OBJECT CLASS CATEGORIES			2014-2015	Total
a. Personnel	2/5 of full-time equivalency		\$20,000.00	\$20,000.00
b. Fringe Benefits				
c. Travel	5,000 miles @ .44+ tolls		\$3000.00	\$3000.00
d. Equipment				
e. Supplies	Office space, communications \$1000.; Copying \$1000.		\$2000.00	\$2000.00
f. Contractual	Errors & Omissions insurance --Grant contract requirement		\$2256.00	\$2256.00
g. Construction				
h. Other				
i. Total Direct Charges	(sum of 6a-6h)		\$27,256.00	\$27,256.00
j. Indirect Charges				
k. TOTALS	(sum of 6i and 6j)		\$\$27,256.00	\$27,256.00
7. PROGRAM INCOME			0	\$0.

- The budget for this one year project includes \$20,000. for professional expenses, this is the equivalent of 2/5th of a full time position. **Lauchlin will be .04 FTE and Linda will be**

.36 FTE. The work of the grant will be done by Linda and Lauchlin Titus. Linda will take the key role. This position has been reduced from full time to part time for this third year of the grant.

- Travel includes costs for 5,000 miles for the year at .44/mile plus tolls= \$3000.
- The supply line includes \$1000. for copying/duplication costs for audit preparation materials and a cost for office space use and communication technologies of \$1000.

These costs are direct costs solely for implementation of this grant.

These costs are charged consistently as direct costs within our organization and not indirect costs. These costs can easily be separated out with accuracy. Copying is solely for this grant. A copier and its supplies are dedicated for the sole use of this grant. One office area is dedicated for the implementation of this grant. It houses boxes of materials necessary for its implementation, as well as a desk area, laptop, and the printer. One cell phone is solely for this grant.(line 207-631-3303) and the cost for that line will be included in our billing during the grant period. It will be the contact line that is used solely for the work of this grant, not AgMatters LLC other work.

There are no costs included for use of other lines, printers, or work areas utilized by AgMatters LLC in their other work.

- The Contractual line includes the **required** Errors and Omissions insurance cost which is \$2,256.
- The total of the costs for implementation of this grant is \$27,256.00.

It needs to be noted that if AgMatters LLC receives more than one grant this cycle, the errors and omissions insurance cost will only be needed in one of the grants, as the policy covers all grants during a year.

Project Title - Increasing the Nutrition Knowledge and Consumption of Specialty Crops by Maine Children and Adults

Project Abstract: (250 words or less)

Nutritious and delicious specialty crops are being produced in every county of our state, but without nutrition education in the classroom and awareness building provided through school gardens many citizens will never purchase them. Maine Agriculture in the Classroom (MAITC), Maine School Garden Network (MSGN), and FoodCorps are submitting this proposal as partners to educate Maine schoolchildren, teachers, parents and volunteers about specialty crops.

This project will provide ready to use classroom lessons for teachers, hands-on experiential learning in the garden and direct links to Maine's specialty crop producers. The effect will be increased consumption of specialty crops in the school cafeterias and purchase from local farmers' markets, farm stands and grocery stores.

Schools across Maine are initiating school garden programs (112 participate in the MSGN registry). Less than 5% of these schools currently have any staff that is compensated for work in these gardens. The FoodCorp program has assisted schools across the state since 2011 in garden education and local food procurement. MSGN provides monthly newsletters, easy to access information on the website, and school garden visits by the coordinator to answer questions and establish links to specialty crop farmers in the area. MAITC provides lessons, fieldtrips and professional development for classroom teachers. Together these partners will prepare the next generation to purchase more of Maine's specialty crops, cook and preserve them in their kitchens and integrate them into everyday healthy meals!

III. Project Purpose

The PROBLEM currently is that Maine students have little awareness of, and as a result, low consumption of the healthy and nutritious Specialty Crops grown in our state. Maine schools have started over 100 programs in the past 3 years, including school gardens and food science projects, but lessons, professional development for teachers and direct connections to local specialty crop farmers is the missing link to the actual increase in consumption of specialty crops in the school cafeterias and at home. There is growing momentum but school budgets cannot absorb the costs to supply these resources. The success of the existing programs requires that we act now. By the end of the grant project the number of schools participating will increase by 20%.

The purpose of this grant is to provide increased nutrition education about, and consumption of, Maine specialty crops. This will be accomplished in 3 ways;

- Maine Agriculture in the Classroom will increase the number of nutrition lessons on their lesson website and implement teacher trainings focused on nutrition and specialty crops.
- Maine School Garden Network will connect local growers of specialty crops to school gardens where students are learning first hand about growing specialty crops. MSGN will assist school gardens and provide networking and mentoring opportunities for educators and volunteers.
- FoodCorp will provide garden and nutrition education to students using specialty crops and link local producers of specialty crops with school food service staff to increase the amount of local food served in the school cafeterias.

IV. Potential Impact

The potential impact of this project is enormous. There are 184,000 school age children in Maine in 2013-14, grades PK – 12. Over 82,000 of these students qualify for free and reduced lunch. Less than 2% of these families are farmers. In one century 96 % of Maine’s people migrated off the farm and no longer grow their own food. Until 2005 formal education in our state did not recognize the importance of agricultural education in most schools. In recent years with the attention to the obesity epidemic and the “real food” movement, the need for agriculture and nutrition education has moved to the forefront.

By teaching Maine students how food is grown and introducing them to producers, we can develop direct connections between growers and consumers. In a time where food safety and food security are topics of concern for everyone, it is the logical step for schools to become an integral part of education about the food system. Students with a better understanding of how food is grown and prepared are equipped to fight obesity and improve their own nutrition. Studies prove that students that grow their food will be more apt to try these new foods. Once Maine students become “food literate”, and understand the healthy options provided by specialty crops these habits will follow them into adulthood.

V. Expected Measurable Outcomes

- 1. GOAL: The number of Maine schools purchasing specialty crops, and the amount they purchase for use in the cafeteria will increase,**
PERFORMANCE MEASURE: Representative Maine School Food Service reports from 2014 and 2015
BENCHMARK: The USDA Farm to School Census reports that 5.64% of Maine’s school foods were sourced locally in 2012. <http://www.fns.usda.gov/farmtoschool/census#/state/me>
We will utilize the 2014 & 2015 reports from the Maine School Food Service for representative schools to assess the increase in the use of specialty crops during the grant period.
TARGET: 15% increase in the use of Maine specialty crops in participating schools,
- 2. GOAL: The number of school garden projects will increase,**
PERFORMANCE MEASURE: Maine School Garden Network Data Base
BENCHMARK: 100 School Gardens at the end of school year 2013-14,
TARGET – 20% increase in school gardens,
- 3. GOAL: The connections between school programs and specialty crop farmers will increase,**
PERFORMANCE MEASURE: Maine School Garden Network Baseline data from the Specialty Crop Grant ending in 2012,
BENCHMARK: 64 Specialty Crop Farmers were connected with school programs during the Specialty Crop Grant ending in 2012
TARGET - 50% increase in specialty crop farmers connected with schools,
- 4. GOAL - The number of teachers integrating nutrition and/or school garden programs into classroom instruction will increase,**
PERFORMANCE MEASURE - Maine Agriculture in the Classroom surveys and records of teachers trained in agricultural, food systems and STEM lessons during the project,
BENCHMARK: The number of teachers that attend the trainings and utilize the online lesson site,
TARGET – 100 teachers will receive training and utilize new lessons on the website developed by funding from this grant,

5. GOAL: The awareness and consumption of specialty crops will significantly increase by Maine students.

PERFORMANCE MEASURE: Representative Maine School Cafeteria surveys and consumption of specialty crops by students using baseline data from the end of the previous school year and 2014 Farm to School Survey.

BENCHMARK: Pre-collected inform will be assembled from representative schools,

TARGET – 20% increase in specialty crop consumption in representative schools.

This project does build on the work of a 2013 SCBGP that added the coordinator's position for MSGN and started several collaborations between school gardens and specialty crop farmers. The project was not funded in 2014 but still has the potential to pick up and continue building the relationship building between schools and local farmers. The addition of the FoodCorps to the project incorporates the aspect of taste testing by students, selecting recipes and empowering students to design menus and really add local specialty crops to their own meals and the school lunch program.

This project also builds on the work of a 3-year USDA-SPECA grant that concludes this year which developed an agricultural lesson website called Teach ME about Food and Farms www.TeachMEFoodandFarms.org over 150 lessons and resources are currently posted for educators. All lessons are aligned to state and national standards. In the first 12 months there were over 200,000 visitors to the site. In 2013 the Next Generation Science Standards were released nationally, and will replace the Maine science standards. In order for the website to remain relevant for Maine teachers, lessons and materials now need to be aligned.

This project has not been submitted or funded by another Federal or State grant program.

VI. Work Plan

The Maine School Garden Network Coordinator will work to connect school gardens across the state with school food service personnel and local specialty crop farmers. Each of the 112 (and increasing) school gardens registered in the MSGN directory will have the opportunity to attend a regional gathering in their area to learn about successful partnerships that are already happening in the state and establish programs in their own schools. FoodCorp Maine will add taste-testing, recipes and links to school cafeterias. Maine Agriculture in the Classroom will distribute the concepts to classroom teachers through lesson access and professional development training. For a more detailed description see activities listed below.

Activities:

- Develop electronic and printed materials and a model for the workshops, training topics, guest speakers, identify regional locations, participants and host sites.
 - Who: Maine School Garden Network Coordinator Ryan Fahey (October - November 2014).
- Coordinate training workshops for school garden educators, local farmers and school food service staff. Thirty or more participants will be expected at each session, representing up to 4,000 students. These gatherings will serve to initiate collaboration between the local farmers, school garden educators and food service staff.

- Who: Maine School Garden Coordinator Ryan Fahey and FoodCorps Service Members (October 2014 - September 2015).
- Continually update and expand MSGN website resources on gardening, nutrition, and collaborations with local farms and school food service staff.
 - Who: Maine School Garden Coordinator Ryan Fahey (Monthly from October 2014 – September 2015)
- Provide online newsletters promoting “Harvest of the Month,” featuring foods from school gardens that are also procured from specialty crop farms for school lunch, promoting the school lunch choices with students and programs given by the FoodCorps Service Members. Share materials with partners at MAITC, school food service, Maine Farm to School Network and statewide agricultural e-newsletters. Post on social networks.
 - Who: Maine School Garden Coordinator Ryan Fahey (Monthly from October 2014 to September 2015)
- Provide direct outreach and assistance to school garden educators across the state to facilitate networking and problem solving between programs and increase awareness local specialty crops and new resources in nutrition curriculum to carry the gardens into the school classrooms. Two gardens per month will receive direct visits.
 - Who: Maine School Garden Coordinator Ryan Fahey, MSGN board & volunteers (October 2014 - September, 2015).
- Locate or develop, align to standards and post on the website, new nutrition lessons and materials covering growing, preparing, preserving and tasting Maine specialty crops.
 - Who: Maine Agriculture in the Classroom and FoodCorps Service Members, (October 2014 - September, 2015).
- Provide training for classroom teachers and Pre-service teachers (college juniors/seniors studying to become teachers), including (when appropriate) fieldtrips to specialty crop farms, on new resources and collect input and data to move these programs ahead into the future.
 - Who: Maine Agriculture in the Classroom (October 2014 - September, 2015).
- Assist in building and maintaining school gardens in up to 50 schools and communities and use them to teach 2,000+ hours of nutrition education to 7,000 or more children in grades PK – 12. Connect 100 or more local specialty crop farmers and producers with school food service staff, conduct cafeteria taste tests of specialty crops and help to incorporate new, healthy specialty crop menu items into the school cafeterias.
 - Who: FoodCorps Maine Service Members (October 2014 - September, 2015).

Each initiative will collect data on number of educators, students, school food service staff and specialty crop farmers participating. This will include student instruction hours, student numbers per educator, and workshop and/or other training hours provided. The project will also report on new menu items and specialty crops introduced through taste testing in schools. Records will be kept regarding attitude changes and anecdotal statements made by students, teaches and specialty crop farmers.

VII. Budget/Budget Narrative

BUDGET	
OBJECT CLASS CATEGORIES	
a. Personnel	
b. Fringe Benefits	
c. Travel	\$3,000.00
d. Equipment	
e. Supplies	2,600.00
f. Contractual	23,400.00
g. Construction	
h. Other	
i. Total Direct Charges (sum of 6a-6h)	\$29,000.00
j. Indirect Charges	DEPARTMENT DOES NOT ALLOW FOR INDIRECT CHARGES FROM THE APPLICANT.
k. TOTALS (sum of 6i and 6j)	\$29,000.00
PROGRAM INCOME	

Budget Narrative

- a. Personnel – none
- b. Fringe Benefits – none
- c. Travel – \$3,000.00 The Maine School Garden Network Coordinator and presenters will be reimbursed for mileage to regional gatherings at the federal rate of .56 per mile (for a personal vehicle). The MSGN Coordinator will also be reimbursed for mileage for school garden visits.
- d. Equipment – none
- e. Supplies – \$2,600.00 -
\$2,000.00 – 20 curriculum @ \$50 each, and \$1,000 (pr0-rated) for printed materials, seeds, lesson demonstration materials for teacher training. [This represents a portion

of the total cost for the addition of nutrition based material with the balance covered by existing MAITC funds.]

\$600 - 1200 printed flyers and announcements for regional gatherings.

- f. Contractual – for each procurement we will use our own procurement procedures which reflect applicable State and local laws and regulations and conform to the Federal laws and standards identified in 7 CFR Part 3019.40 through 48 or 3016.36, as applicable.

\$23,400.00

\$10,000 will be provided to FoodCorp Maine (\$1,000 per service member) to integrate specialty crop grant initiatives into their plan of work from October 2014 – August 2015.

\$7,800 will be contracted with the MSGN Coordinator for 10 hours per week @ \$15 per hour for the duration of the grant to perform the activities in the work plan.

\$5,000 will be contracted by MAITC with education professionals to align nutrition and specialty crop lessons, and web professionals to add lessons and search fields to the TeachME lesson website.

\$600 will be spent to increase usability and compatibility of the MSGN website with the lesson site and specialty crop farms' websites.

The MAITC website contracts are hourly rates of no more than \$45 per hour by for entering new lessons and managing the search engines for State and National Standards and the Next Generation Science Standards on the current website. This contract was negotiated through the previous Secondary Agriculture Education Challenge Grant No. 2011-38414-30495 including obtaining a cost/price analysis from at least three contractors who can perform the service. The process of the cost analysis has been reviewed and each element of cost evaluated to determine reasonableness by the Secondary Agriculture Education Challenge Grant personnel. The continuation of this program will maximize efficiency of the program already set in place by the previous grant.

- g. Construction – none

- h. Other - none

VIII. Project Oversight (No longer required)

Maine Agriculture in the Classroom Executive Director will oversee the project.

IX. Project Commitment

The need for education is twofold. Maine has learned that educating students about local foods increases their desire for it. The biggest challenge for schools that are bringing local specialty crops into the cafeteria is for the students to make the healthy, local choice in the lunch line. Some students have little knowledge of what local foods are, including how they taste, what they look like or how to eat them, and are not making the connection with what they choose to eat in school.

The second is the connection for food service staff to the school garden projects and specialty crop producers. When interviewed, staff said they were unfamiliar on how to obtain

products, how to prepare in a pleasing format, and how to merchandise it to students. The work that the Maine School Garden Network and FoodCorps are doing can be continued and maximized by gathering representatives to discuss and plan how to move this initiative forward into the future. Classroom teachers need to use literacy materials and lessons to support the movement in their students' day outside the cafeteria. They can only do this with age-appropriate curricula that is aligned to the standards that they are instructed to teach.

PLEASE SEE LETTERS OF COMMITMENT AS PART OF THIS NARATIVE

Other organizations in support of this initiative are listed as partners on the “Teach ME About Food and Farms” Lesson website at <http://teachmefoodandfarms.org/contact> and include; Maine Farm to School, University of Maine Cooperative Extension, Maine Farm Bureau, Maine Department of Education, Maine Nutrition Council, Healthy Maine Partnerships, Maine Organic Farmers and Gardeners, Maine Association of Conservation Districts.

Other sponsors of MAITC Teacher Trainings and Professional Development include; The Maine Wild Blueberry Council, The Maine Potato Board, New England Vegetable & Berry Growers, Maine State Pomological Society, Maine Antique Tractor Club.

Project Title - Enhancing Consumer and Producer Awareness of Maine Maple Syrup

Abstract

Title: Enhancing Consumer and Producer Awareness of Maine Maple Syrup

Abstract:

In 2013, Maine produced 450,000 gallons of syrup making it the third largest producing state in the United States¹. The value of this syrup is \$23.9 million and is calculated with the understanding that Maine sells about 90% of its crop as bulk syrup rather than retail.² Maine increased its numbers of licensed maple syrup producers from 349 in 2011 to 452 in 2014³. Maple syrup production is expanding rapidly as both a commodity crop for some producers, and an integral economic addition for diversified Maine farm businesses. To capture the full retail value of the syrup, **producers must address three components of retail excellence: the quality, safety and desirability of consuming maple syrup.** Posters, rack cards, flyers, recipe booklets, media posts and marketing directed to the public will enable this. In addition to events aimed at the public, producers **will receive** educational assistance about **proper** food safety and certification processes to ensure that the highest quality products **can be promoted** to the public.

III. Project Purpose

Promotion

In 2013, Maine produced 450,000 gallons of syrup making it the third largest producing state in the United States⁴. The value of this syrup is \$23.9 million yet much of Maine syrup is sold bulk to out-of-state buyers.⁵ To increase sales and capture the full retail value of the syrup, maple producers need to enhance the quality and safety of their products and **denote this to the public via certification processes.** Producers **need to conduct and advertising campaign and take the opportunity to market the research-based⁶ health benefits⁷ of maple syrup to the public.** **Methods** to enable this are posters, rack cards, flyers and media posts directed to the public explaining the

¹http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/0605mpl.pdf Accessed Jan. 21, 2014

²http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/0605mpl.pdf Accessed Jan. 21, 2014

³ Personal communication with Ron Dyer, Department of Agriculture, Forestry and Conservation, Jan. 30, 2014

⁴http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/0605mpl.pdf Accessed Jan. 21, 2014

⁵http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/0605mpl.pdf Accessed Jan. 21, 2014

⁶<http://web.uri.edu/pharmacy/meet/navindra-seeram/> Research website. Accessed July 21, 2014.

⁷<http://www.internationalmaplesyrupinstitute.com/projects.html> Maple Nutritional and Health Benefits Information. Accessed July 21, 2014.

desirability of maple syrup. Media and marketing will also explain the “Maine Story” of maple syrup to differentiate it from other maple syrup. In addition to marketing and educational events aimed at the public, producers also need educational assistance about food safety and certification processes **to market** the highest quality products **to** the public.

The state legislature recognized the potential of the maple syrup industry in Maine by establishing a task force to study the industry in June 2011. In their December 2011 report to the legislature the Maple Task Force Study Group recommended:

*There is also a great need for education for producers, processors, buyers and the public about the value of syrup, the benefits of sugarbushes to both individuals and the public and the process of producing syrup.*⁸

Food Safety

Food safety has become an important topic for consumers. The Food Safety Modernization Act of 2011 has one mandate that directly applies to maple producers: *Facilities that manufacture, process, pack or hold human food would be required to identify potential food-safety hazards and implement controls to reduce such risks.*⁹ One of two regulatory proposals made Jan. 4, 2011 to carry out the core of the food safety act would give companies one year to develop a formal plan for preventing the causes of food illness.¹⁰ These new regulations will require significant education for maple producers in Maine, many of whom have never been required to implement a formal plan or register as a food production facility. While the Food Safety Modernization Act of 2011 will eventually establish food safety practices and requirements, many food producers are interested in being proactive and are increasingly searching for information that will help them produce the safest product possible and **market that status to consumers**. Examples of this include the new, voluntary Vermont Certified Producer Program **that involves inspections and special labels for syrup that passes inspection. This enables consumers to choose the highest quality product.**

Best Practices and Certification

While the Maple Quality Control Manual, Extension Publication #7038, is a good resource for producers who want to use best management practices, it is not a certification document. Currently, there is no GAP, (Good Agricultural Practices) or HACCP, (Hazard Analysis and Critical Control Points) program or handbook for maple producers. Many associations have an assortment of best management practices or voluntary certification processes for their jurisdiction and while these resources help, a formal process should be created to ensure the best production practices possible and allow producers to achieve a level of certification **that they can market to consumers wishing to purchase the highest quality syrup**. UMaine Cooperative Extension has worked closely with the maple industry, authoring the Maple Syrup Quality Control Manual, and providing research on microbial contamination and best canning practices. Extension is, therefore, well placed to create GAP or HACCP plans both for Maine producers

⁸ www.getrealmaine.com/_ccLib/image/articles/PDF-3.pdf page 12 Accessed April 23, 2013

⁹ <http://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm334114.htm> Accessed April 23, 2013

¹⁰ http://www.pressherald.com/news/nationworld/food-illnesses-rise-as-new-rules-loom_2013-04-19.html.

Accessed April 23, 2013.

and for the industry as a whole. Producers can use these plans as a marketing tool to show consumers interested in purchasing the highest quality product possible.

Priority

Food safety, best practices and optional certification fit under the Maine Priority 2: *Enhancing food safety education, primarily in relation to new FDA rules regarding improved handling and processing specialty crops*. The Commissioner of Agriculture, Conservation and Forestry established this priority.

This proposal falls under several recommended project areas as listed by the AMS (USDA/Agricultural Marketing Service):

- a. Increasing child and adult nutrition knowledge and consumption of Specialty Crops
- d. Developing “Good Agricultural Practices”, “Good Handling Practices”, “Good Manufacturing Practices”, and in cost-share arrangements for funding audits of such systems for small farmers, packers, and processors
- f. Enhancing food safety

This project will not be and has not been submitted to or funded by another Federal or State grant program.

IV. Potential Impact

As an industry, maple syrup production is expanding rapidly and is an integral economic addition for diversified farms in Maine as well as across the Northeast. There is a growing demand and need for relevant and credible education for both consumers and producers about the economic and health benefits of maple syrup. Producers also need advertising materials to engage the public. There are 452 licensed Maine producers and an unknown number of hobbyists who need information on food safety and outreach information. Producers will be positively impacted by this project and the public will also benefit as the recipients of the best quality products for consumption.

V. Expected Measurable Outcomes

Goal # 1 – Conduct three food safety and HACCP/GAP workshops for maple producers, one each in southern, central and northern Maine. Establish a downloadable HACCP (Hazard Analysis and Critical Control Points) plan for maple producers on the UMaine Extension maple webpages. Produce a UMaine Extension YouTube video on HACCP plans.

Performance measures: number of producers participating in workshops and number of producers with completed HACCP plans. Currently, only one maple facility has a GAP plan but it is a diversified farm and the GAP plan refers only to the vegetable portion of the operation. By September 2015, maple operations will have a food safety plan in place as determined by surveys after the workshops. They will use the plan as part of their advertising.

Goal # 2 – Develop high quality, promotional materials and customized displays for maple education and promotion. These will be used at local events, fairs, festivals, etc. and enable producers to market their maple products at regional and statewide high profile events. Fund one

person to attend an International Trade Mission to promote Maine Maple Syrup. Revise the Maine Maple Producers website to include the “Maine Maple Story” and educate consumers about the uses of Maine maple syrup. Through these goals the association will:

- Increase awareness of the many uses of Maine maple syrup;
- Increase awareness of the differences in taste and quality of Maine maple syrup vs. maple syrup from other states;
- Increase understanding of supporting local producers and the Maine way of life.

As a result of the above activities at the end of one year:

- 25% of the Maine Maple Producer Association members (180) will attend a food safety for maple syrup production workshop and 25% (11) of workshop attendees will have a food safety and record-keeping plan in place by September 30, 2015.
- Marketing support will increase retail sales of syrup and syrup products by 5% a year as reported by New England Ag Statistics.
- Marketing materials will be used for at least five events to promote sales and education about maple syrup. This will increase retail producer sales at these events by 10%.
- Additions to the UMaine Extension Maple production webpages will include a printable HACCP/GAP food safety plan for producers to complete and print for their records.
- Credible promotional outreach by the Maine Maple Producers Association through workshops, newsletter articles, improved website and their Facebook page.

VI. Work Plan

Timeline of Project Activities:

Activity Begin Fall 2014 and continue to September 2015: Support the maple industry in the state of Maine by designing educational marketing products about the value of Maine maple syrup. The key messages will be to:

- To Broaden Use - Maine syrup isn't just for pancakes anymore!
- To Differentiate Maine Syrup From Others – Tell the Maine Maple Story-it's pure and sweet and great quality.
- Materials will include:
 - Recipe Booklets - Small booklets that would be free and available to any consumer interested in using maple syrup beyond pancakes and waffles, such as for cooking and baking. The booklet would be offered via press releases and articles, in radio ads, and on labels that can be affixed to products, or ordered through a website. These booklets will be 3 1/2" x 5" and include the "Maine Maple Story" and how to substitute maple syrup for sugar in cooking and baking recipes.
 - Promotional Flyer/Rack Card - Designed specifically to be inserted into the Department of Tourism's information packets sent in response to inquiries from potential visitors to the state. This flyer would include information on the Maine maple industry and would have names and locations of maple operations (during operating season) where a tourist could get a tour. The flyer could also serve as a way to

convince visitors to bring the taste of Maine home to their families in the form of maple syrup.

- Media Relations - Develop strong, newsworthy articles that could run in local newspapers informing readers about the Maine maple industry (stories ranging from statistics about the current years' production, to a profile on a certain Maine maple farmer). Separately-or in addition to this-could be the development of a "Maine Maple Spokesperson" that could work with local news stations to go on air and talk about the Maine Maple industry. This spokesperson would be an actual Maine maple producer, which would help make them real to the audience. As this spokesperson becomes more familiar, it will keep people aware and thinking of Maine Maple Products. Designate a Maine Maple "Capitol" - Having a town be the "Maple Capitol" of Maine allows for promotional cooperation with tourism, meal and lodging promotions activities in the area.
- Enlist a Spokesperson - Having a well-known, well-polished person act as a spokesperson for the industry serves as a draw to events and helps generate news coverage.
- Recipe Contests and Promotions - Promoting Maine Maple Syrup as a unique ingredient for both top-shelf recipes and everyday treats could drive purchases among consumers. News coverage of contests is a great visibility factor, and spin-off products, such as cookbooks, can generate additional publicity and revenue.
- Children's Art and Essay Contests - Maine's 4th and 5th grade curriculum includes education on trees and other natural resources. Develop a yearly art and essay contests for youth.

Responsible Group: Maine Maple Producers Association Grants Committee will create a Request for Proposals, solicit proposals, and choose an agency to develop Recipe Booklets and Promotional flyers/rackcards. **Timeline:** November 2014 to December 2014.
The Association Grant Committee will enlist a spokesperson for maple, set up one or more recipe contests, create media submissions, and organize Children's Art and Essay Contests. **Timeline:** September 2014 to December 2015

Activity: Support the maple industry in the state of Maine by hiring a web consultant to work with the Maine Maple Producers Association webmaster to design improvements to the Maine Maple Producers website: <http://www.mainemapleproducers.com/> to be more interactive and accessible to the public accessing it via smartphones and tablets.

Responsible Group: Maine Maple Producers Association Grants Committee will create a Request for Proposals, solicit proposals, and choose an company to develop improvements to the Association website. The RFP will stipulate that the contract for services will not exceed the salary of a GS-15 step 10 Federal employee in our area as stipulated at <http://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/2013/general-schedule/>
Timeline: November 2014 to January 2015 to send out the RFP and choose a consultant.
Timeline: January 2015 to December 2015 to evaluate and make improvements to the website.

Activity: Integrate in the UMaine Extension website an internet-based, downloadable HACCP or GAP plan for maple producers and conduct benchmark food safety workshops in three locations around the state

Responsible Group: Cooperative Extension staff, Kathy Hopkins and Beth Calder

Timeline: January 2015 to June 2015

Activity: Conduct food safety workshops for the Maine maple producers

Responsible Group: UMaine Cooperative Extension staff, Kathy Hopkins and Beth Calder

Timeline: November 2014 to September 30, 2015

VII. Budget /Budget Narrative

This marketing campaign includes several projects to capture the full retail value of maple syrup and help producers address components of retail excellence: the quality, desirability and safety of consuming maple syrup.

Contractual (Total - \$15,000) The contract for services will not exceed the salary of a GS-15 step 10 Federal employee in our area as stipulated at <http://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/2013/general-schedule/> September 2014 to December 2015. All Contractual procurement procedures will reflect applicable State and local laws and regulations and conform to the Federal laws and standards identified in 7 CFR Part 3019.40 through 48 or 3016.36, as applicable. Timeline: November 2014 to December 2015.

- Website design and implementation ($\leq \$47.74 \times 62$ hours) \$3,000
- Ad Agency Fee – 12 months @\$1,000/month \$12,000
($\leq \$47.74/\text{hour} \times 20$ hours/month)

Contractual (\$13,210):

Contracted Design of Promotional Materials:

- Labels and Hangtags
 - Art design and layout \$2,750
 - Creative writing/editing \$1,100
 - Project management ($\leq \$47.74/\text{hour} \times 18$ hours) \$ 900
 - Misc. costs \$ 500
 - Subtotal \$5,250
- Maine Maple Story Labels
 - Art design and layout \$1,430
 - Creative writing/editing \$ 880
 - Project management ($\leq \$47.74/\text{hour} \times 14$ hours) \$ 700
 - Misc. costs \$ 500
 - Subtotal \$3,510
- Recipe Booklets (3.5” by 5” 2-color)
 - Art design and layout \$ 990

○ Creative writing/editing	\$1,100
○ Project management(≤\$47.74/hour X 12 hours)	\$ 600
○ Misc. costs	\$ 700
○ Subtotal	\$4,450

Total Costs: \$28,210

In Kind Support:

Extension personnel staff time will be required to conduct HACCP/GAP trainings and to write a downloadable HACCP/GAP plan for producers to download and fill out.
200 hours @ \$40/hour x 2 Extension personnel: **\$16,000**

Program Income: Sale of posters, hangtags, recipe booklets, brochures to maple producers: estimated from sales of posters, hangtags, recipe booklets and brochures – approximately \$1,000 first year and \$500 the second year and \$500 in the third year to create a **reprinting fund for continued sale and use of promotional materials that will benefit all maple producers in Maine.**

Please refer to USDA SCBGP 2014 Guidance Document for allowable costs in Appendix B and for Budget Narrative Requirements in Appendix D.

Remember that in each budget category in which a cost is incurred that cost must have an explanation in the budget narrative.

BUDGET	
OBJECT CLASS CATEGORIES	
a. Personnel	\$
b. Fringe Benefits	
c. Travel	
d. Equipment	
e. Supplies	
f. Contractual	\$28,210
g. Construction	
h. Other	

i. Total Direct Charges (sum of 6a-6h)	\$28,210
j. Indirect Charges	DEPARTMENT DOES NOT ALLOW FOR INDIRECT CHARGES FROM THE APPLICANT.
k. TOTALS (sum of 6i and 6j)	\$28,210
PROGRAM INCOME	\$1,000 first year and an additional \$500 in second year and \$500 in third year. Total - \$2,000 for reprinting fund that will be used to purchase additional marketing and promotional materials for sale to maple producers.

VIII. Project Oversight

The Maine Maple Producers Association Grant and Promotion Committee, chaired by Eric Ellis, and the Maine Maple Producers Board of Directors will conduct project oversight. They will monitor for compliance with state and Federal rules and procedures and will compile reports as required. Treasurer, Mike Bryant, will oversee expenditures and monitor timelines for work. UMaine Cooperative Extension will conduct evaluation of the food safety trainings. UMaine Extension has an established track record in evaluating the costs, benefits and impacts of projects.

IX. Project Commitment

This project will build on the success of the Maine Maple Producers in developing an identity for themselves as producers and enable them to continue and expand their outreach about the value of maple syrup and the maple syrup industry to the public. All licensed maple producers in Maine will benefit from a promotional campaign even if they do not belong to the Maine Maple Producers Association. Collaborating on HACCP/GAP and food safety education will build on the positive relationship that UMaine Cooperative Extension has developed with the maple industry. The North American Maple Syrup Council has funded \$28,815 to the University of Maine through a competitive process for maple food safety research. The North American Maple Syrup Council supports the HACCP and GAP portion of the implementation of this project and sees that a GAP plan that any producer can use to promote and enhance the value and marketing of maple syrup will be useful.

Project Title - Improving Maine Potato Yields through Increased Rotation Lengths and Improved Rotation Crop Profitability.

Project Abstract

Potato producers in Maine are in need of mechanisms in which to improve potato yields in order to sustain market viability. One such mechanism, as identified by the Maine potato industry's "Yield Initiative Taskforce," is through the lengthening of rotations (increasing the time between potato croppings on a piece of land). Economic challenges arise under this scenario in Maine due to increasing times between potatoes (typically the main cash crop), lack of crop diversity in current potato-cropping portfolios, and, lastly, a lack of identified potential alternative crops, alternative markets for existing crops, and value-added processing potentials for new and existing rotation crops.

The goal of this project is to identify potential crops that could be grown in conjunction with potatoes that would allow producers improved economic returns, allowing growers to expand current rotation lengths while directly and indirectly improving potato yields. Through the iterative process of identifying climate suitable alternative crops, their market potential, value-added potential, and effects upon potatoes, we seek to improve the overall sustainability of the Maine potato industry for the coming years.

III. Project Purpose:

Market share of potatoes grown in the northeast US has decreased, losing out to competitors located in western North America. The greatest factor to this is the comparative yield lag experienced by the state of Maine as compared to the west. Western potato production has yielded an average range of 132% - 224% of Maine's potato yields, depending upon the specific year and location. The result of this has been differential pricing, where western production has been able to provide comparative discounts (15% - 20%) based upon achieved yields. The issue of Maine's potato market disadvantage has been realized, and has led to the formation of a Potato Yield Initiative Taskforce, that includes growers, key stakeholders, and industry professionals from throughout the state.

The successful future of the Maine potato industry demands that it maintain both economic and environmental sustainability. One of the influential factors in the long-term success of Maine potato production in the future will be the non-potato crops grown in the system. As seen in Table 1, Maine has been disadvantaged in the number of saleable crops grown in conjunction with potatoes. Increased capacity for marketable crops allows for increased rotation lengths, and decreased economic pressures on potato producers to grow potatoes more frequently in order to remain financially viable. Numerous studies conducted in Maine and the Maritime Provinces have concluded that decreasing the frequency of growing potatoes provides quality and quantity benefit to subsequent potato crops within the rotation system (Larkin and Halloran, 2014; Larkin et. al., 2011; Halloran et. al., 2008, Carter and Sanderson, 2001; Angers et. al., 1999).

Table 1. Value of crops sold by state 2011-2012 (Farmgate \$ x \$1,000,000). Source: USDA-NASS

CROPS	Washington	Idaho	Maine
Potatoes	777.4	978.4	146.0
Hay (inc alfalfa)	683.7	1,072.9	39.8
Wheat	1,134.7	786.2	
Barley	43.4	267.4	2.0
Corn (grain)	171.6	135.4	
Beans Dry Edible	64.7	63.0	
Peppermint	35.0	38.0	
Hops	141.1	14.8	
Lentils	28.3	11.3	
Canola	4.4	7.8	nd*
Pea Seed Wrinkled	9.4	5.5	
Peas Dry Edible	21.2	3.9	
Oats	0.6	3.2	3.0
Spearmint	33.3	2.0	
Peas Austrian Winter		1.7	
Broccoli			nd
	<i>Farmgate \$ (x 1,000,000)</i>		
	<i>2011-12</i>		

*nd= not disclosed (insufficient amount of data or privacy disclosure)

The goal of this project is to research and determine the economic feasibility of crops, some of which may be defined as USDA-AMS specialty crops, that can be grown in conjunction with potatoes for our climate area, ultimately allowing for increased rotation lengths. Determinations of agronomic fit, benefit to potato production, economic benefit to the producer, market assessments, and value-added processing potentials will be evaluated for each selected crop.

The characteristics of a successful potato rotation crop will need to include crop diversity (warm-season/cool-season, broadleaf/grass crops), positive direct benefit to potato quantity and quality, and the provision of additional net-farm income by the rotation crop through its own harvest and sale, or through the increased value of the subsequent potato crop. Knowledge and improvement to the economic facet of rotation crops will have a significant, positive impact on potato yield and quality in Maine, and provide our producers with greater financial diversity and flexibility.

The project is to only enhance the competitiveness of the potato crop. Traditionally oats, barley, canola and sometimes soybeans are used as part of the two year rotation with potatoes. We would like to extend the rotation to three years. The benefit of the longer rotation will be to improve the quality and quantity of potatoes. We are at a competitive disadvantage to potato growers in the Pacific Northwest due the fact that our yield is about half of what it is in the Pacific Northwest. This project is too look for additional rotation crops that can be included with the current rotations to benefit the potato crop.

This project has not been funded by any other source either State or Federal.

IV. Potential Impact:

In a 2003 report entitled “A Study of the Maine Potato Industry: It’s Economic Impact”, the Maine Potato Industry was found to account for \$293,000,000 in direct economic impact, \$179,200,000 in indirect impact, and \$67,800,000 in induced impact. In total, it was found responsible for \$540,000,000, and employment of 6,150 people within the state’s economy.

The goals of this project seek to maintain or improve these economic benchmarks by improving potato yields through lowering its production footprint and improving the rotation crop economy by seeking new, innovative crops and/or markets for existing crops.

Direct beneficiaries of the project will be the approximately 300 Maine potato producers and the approximate 125,000 acres of crop land they farm. Through research and identification of alternative crops suitable to potato rotations and their market development, the overall goal is to allow these farms to remain viable financial entities that will sustain their economic impact to the state’s economy into the future.

V. Expected Measurable Outcomes:

- 1.) At least 10% of potato producers will develop a plan to transition from a two-year rotation to a three-year rotation. Increasing lengths of rotation will benefit potato production by increasing potato yields during the potato year of production.
- 2.) Alternative crops, including USDA-AMS designated specialty crops, will be identified that will fit potato production systems, and will be successful at commercial production scale. Finding and producing alternative production crops will decrease the reliance current potato producers have on growing potatoes to achieve financial viability at the farm-level. At least 5% of potato producers will develop a plan to adopt a new saleable crop they haven’t grown in the recent past.
- 3.) Research will be conducted on the development and marketing of existing rotation crops in order to maximize their profits. Dollar value of sales to newly developed markets or market outlets will be monitored.
- 4.) Feasibility of value-added processing will be conducted for successfully identified rotation crops. Creation of new value-added enterprises that are serviced by potato-industry growers will be monitored.

5.) Once identified, alternative crop agronomics will be researched; and growers will be educated to its production practices in partnership the University of Maine and UMaine Extension personnel.

6.) A farm financial analysis tool will be constructed for use by potato producers to simulate changes in crop rotation choices and their effects on farm-level finance dynamics. Growers will be able view estimates of individual crop budgets within the farm-level system and observe the total effects of changes to net-farm income. At least 10% of potato producers will utilize this financial tool once complete.

It is anticipated that, as a result of this project, and the increased rotation lengths between potato crops, potato yields will improve. However, we do not expect that potato yield improvements would be measurable within the three-year proposed timeline in which to conduct this work and have it adopted and implemented in the field. Based upon past research, gains in potato yields from increasing rotation lengths, typically, requires two to three cycles of the rotation to realize gains.

As part of this project we will assess the current rotation practices of the industry. We propose to do this by surveying the growers themselves. We will ask questions about what is their current rotation made up of, how long of a rotation do you generally use and the number of acres. There may be more questions that when we get more involved we may want to ask. At the end of the project we will again survey growers to understand the progress we have made towards our goals.

Expected Outputs and Outcomes Table

Output	Output Performance Measure	Outcomes	Outcome Performance Measure	Impacts
Identify new potential rotation crops.	Number of crops identified as having potential for adoption in the region as of September 2015.	Four rotation crops will be identified that will merit further research and development by September 2015.	Number of potential rotation crops identified by September 2015.	Finding and producing alternative production crops will decrease the reliance current potato producers have on growing potatoes to achieve financial viability at the farm-level.
Analyze and develop markets	Number of individual market	Potato producers will gain	Number of reports disseminated by	With increased knowledge regarding

for potential and existing rotation crops	reports on potential and existing rotation crops as of September 2015.	knowledge specific to marketing and sales of rotation crops by September 2015.	September 2015.	markets, rotation crops will gain in value to potato producers.
Identify crops that warrant feasibility studies into local value-adding opportunities.	Number of value-added enterprises identified as of September 2015. At least two will be identified.	Future feasibility studies will be conducted. 2016/17	Number of enterprises studied by 2017. At least one will have a feasibility study conducted.	Creation of new value-added enterprises that are serviced by potato-industry growers will economically benefit rotation crop adoption.
Create a farm financial analysis tool.	Create and beta test financial tool with potato producers by September 2015.	10% of potato producers will utilize the farm financial to make cropping decisions by September 2016.	Percentage of potato producers that have used the farm financial tool by September 2016.	The farm financial tool will allow producers to simulate changes in crop rotation choices and their effects on farm-level finance dynamics.

Outcome Achievement Timeline

Outcome	Assessment Date(s)
Transition from 2 to 3 year Rotation	September 2016, 2017
New Rotation Crop Adoption	September 2016, 2017
New Market Development	September 2015, 2016, 2017

Value-added Processing Enterprise Feasibility	September 2016, 2017
Farm Financial Tool	September 2016, 2017

VI. Work Plan:

The Maine Potato Board proposes to hire a full-time staff member for a period of three years for this project. The proposed position will be titled “Crop Development Specialist.” The Crop Development Specialist will be responsible for the implementation and oversight of the project, including any collaborative efforts utilizing external personnel from the University of Maine, UMaine Extension, or private consulting groups.

The Maine Potato Board proposes to hire a full-time staff member for the duration of this project. The proposed position will be titled “Crop Development Specialist.” The Crop Development Specialist will be responsible for the implementation and oversight of the project, including any collaborative efforts utilizing external personnel from the University of Maine, UMaine Extension, or private consulting groups.

Maine Potato Board staff will work with the successful candidate to form an advisory committee of farmers and others as needed which will serve to assist and direct the new hire. It’s expected that the new hire will conduct an assessment of current practices and market situations for rotation crops, as well as the future cropping goals of growers within the Maine potato industry. Building upon these assessment efforts, the successful candidate will conduct research into new crops, new markets for existing crops, and work with University of Maine and Umaine Extension personnel to determine the potential for successful cropping and financial prospects for respective crops. The results of this effort will be formulated into reports that will be available to the Maine potato industry, and will be presented at the annual Maine Potato Conference.

To aid the successful candidate in researching rotation crops and markets, and developing market networks, it is expected that they will utilize a travel budget to attend crop and trade conferences in which applicable production and marketing information will be focal points of the event. It is expected that they will travel to three or four regional/national conferences per year.

Synchronously to new crop and market assessments, the successful candidate will be utilizing researched information to determine the feasibility of value-added enterprise opportunities that will allow for candidate rotation crops to be processed within the state or geographic area of potato production. For the given timeline of this grant, it is only foreseen that only crops will be identified that warrant future investigation into the feasibility of value-adding.

Lastly, it will be the responsibility of the successful candidate to oversee the construction of the farm financial tool for potato producers to utilize in making crop selection decisions. This tool will allow producers to estimate the financial consequences of individual cropping choices, and the ability to view the whole-farm effects of augmenting the makeup of their crop portfolios. Portions of this work will likely need to be supported by personnel from the University of Maine and UMaine Extension. Results and findings of this portion of work will be disseminated

through workshops, one-on-one consults, and presentations at industry meetings and/or conferences. By September 2015, it is expected that the farm financial tool will be completed, but will need to be beta-tested prior to full dissemination.

Work Plan Timeline

Proposed Activities	Personnel Involved	Timeframe
Maine Potato Board will hire a full-time staff member for a period of 3 years to conduct and oversee this project.	Donald Flannery, Timothy Hobbs, George McLaughlin	August 2014 - September 2014
Form potato industry-based board of advisors	Crop Development Specialist, Donald Flannery, Timothy Hobbs	July 2014
Conduct grower surveys and needs assessments	Crop Development Specialist	October 2014 - December 2014
Research alternative crops, markets, and respective financial prospects to formulate reports. Travel to regional/national conferences to gain crop and market specific information. Present reports to potato industry and present findings at Maine Potato Conference.	Crop Development Specialist in collaborative effort with University of Maine and UMaine Extension personnel	January 2015-ongoing
Build farm financial tool. Conduct beta-testing with a small group of growers.	Crop Development Specialist in collaborative effort with University of Maine and UMaine Extension personnel	January 2015-September 2015

Identify crops and value-added opportunities that warrant full feasibility studies in the future.	Crop Development Specialist in collaboration with a consulting firm	January 2015-September 2015
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VII. Budget / Budget Narrative

Budget			
Object Class Categories	Year 1	Year 2	Year 3
a. Personnel	\$60,000	\$61,800	\$63,654
b. Fringe Benefits	\$34,800	\$35,844	\$36,919
c. Travel	\$9,640	\$9,930	\$10,227
d. Equipment	\$3,500	0	0
e. Supplies	0	0	0
f. Contractual	\$17,060	\$17,426	\$14,200
g. Construction	0	0	0
h. Other	0	0	0
i. Total Direct Charges	\$125,000	\$125,000	\$125,000
j. Indirect Charges	0	0	0
k. TOTALS	\$125,000	\$125,000	\$125,000
PROGRAM INCOME			

A. Personnel

It is expected that the Maine Potato Board will seek to hire an individual to staff a full-time position that will conduct and oversee this project. The successful candidate for this position

should have a background in agronomy, consulting, and, preferably, have an interest or familiarity in agricultural systems. A wage band for the proposed position was determined to be \$45,000-\$60,000 depending upon educational background and experience. For the purposes of budgeting, we have set the cost of personnel at the high limit of the wage band. For each successive year of the project, costs are calculated assuming a 3% inflation adjustment.

Crop Development Specialist

Requested Amount- Year 1.....\$60,000
Requested Amount- Year 2.....\$61,800
Requested Amount- Year 3.....\$63,654

B. Fringe Benefits

The Fringe Benefit Rate for the Maine Potato Board is calculated at 58% of gross salary.

Fringe Benefit for Crop Development Specialist

Requested Amount- Year 1.....\$34,800
Requested Amount- Year 2.....\$35,844
Requested Amount- Year 3.....\$36,919

- Salary = \$60,000
- Medical Insurance = \$17,208
- Dental Insurance = \$315
- Medicare = \$1,200
- Retirement = \$17,850

C. Travel

Reimbursed travel rates for the Maine Potato Board are calculated at \$0.58/mile. It is estimated that this position would require up to 8,000 miles of vehicle travel per year. In addition, we are assuming the position would require travel to national conferences, workshops, or expos. For our budget, we are allotting for four trips at an estimated cost of \$1,250 each.

Mileage (8,000 miles per year)

Requested Amount- Year 1.....\$4,640
Requested Amount- Year 2.....\$4,780
Requested Amount- Year 3.....\$4,923

Example of Monthly Estimated Travel Mileage and Expense

Destination	Mileage	Travel Purpose	Expense
Orono, ME	300	Meet with UMaine Ag Faculty	\$174.00
Caribou, ME	24	Farmer Meeting	\$13.92
Houlton, ME	96	Farmer Meeting	\$55.68
St. Agatha, ME	102	Farmer Meeting	\$59.16
Mapleton, ME	16	Farmer Meeting	\$9.28
Fort Kent, ME	111	Farmer Meeting	\$64.38
Mars Hill, ME	31	Farmer Meeting	\$17.98
Total	680		\$394.40

Professional Conference Attendance (4 per year)

Requested Amount- Year 1.....\$5,000

Requested Amount- Year 2.....\$5,150

Requested Amount- Year 3.....\$5,304

Example of Potential Travel Expenses for Attending Confereneeces/Workshops

Destination	Orlando, FL	Burlington, VT	Sturbridge, MA	
Event	Potato Expo	Hops Conference	Harvest NE Ag Marketing Conference	
# People Traveling	1	2	2	
#Days	4	3	3	
Airfare ^a	\$500	\$0	\$0	
Ground ^b Transportation	\$190	\$0	\$0	
Lodging	\$600	\$404	\$250	
Meals ^c	\$204	\$244	\$276	
Mileage ^d	\$187	\$522	\$515	
Conference Registration	\$855	\$90	\$165	Total
Total	\$2,536	\$1,260	\$1,206	\$5,002

a.) Airfare is based on leaving from Bangor, ME to selected Destination

b.) Ground Transportation is estimated rental cost from destination + \$40 fuel.

c.) Per Diem Meal Rates based upon <http://www.defensetravel.dod.mil/site/perdiemCalc.cfm>

d.) Mileage based on traveling from Presque Isle, ME to destination or selected Airport at \$0.58/mi.

Total Travel Request

Requested Amount- Year 1.....\$9,640

Requested Amount- Year 2.....\$9,930

Requested Amount- Year 3.....\$10,227

These costs have yet to be determined. The travel destinations are not yet known and will develop throughout the project. Since these cost are site specific we estimated what the travel costs will be.

D. Equipment

It is anticipated that a new computer, new phone, and new printer will be required for the successful candidate of the Crop Development Specialist position.

Requested Amount- Year 1.....\$3,500

E. Supplies.....(none requested)

F. Contractual

It is expected that Crop Development Specialist will need to seek aid in addressing some of the proposed plans of work for the position. Currently, it is expected that the Maine Potato Board will need to hire, at

least in part, a consulting firm in order to successfully research, complete feasibility studies, and compile reports for potential alternative crops. **We will use procurement procedures which reflect applicable State and local laws.**

Part-time Consulting Firm Contract to complete feasibility studies
Requested Amount- Year 1.....\$17,060
Requested Amount- Year 2.....\$17,426
Requested Amount- Year 3.....\$14,200

Our intention is to be on a flat rate basis. The services covered will likely be market research for each potential rotation crop that is identified as a potentially viable crop.

G. Construction.....(none requested)

H. Other.....(none requested)

I. Total Direct Charges

Requested Amount- Year 1.....\$125,000
Requested Amount- Year 2.....\$125,000
Requested Amount- Year 3.....\$125,000

J. Indirect Charges.....(none allowed)

K. TOTALS

Requested Amount- Year 1.....\$125,000
Requested Amount- Year 2.....\$125,000
Requested Amount- Year 3.....\$125,000

VIII. Project Oversight:

The project will be overseen utilizing several different methodologies. Maine Potato Board staff will have direct oversight of the project and the successful candidate for the Crop Development Specialist position. This position will work with an advisory committee that will help direct plans of work and research foci for the project. This advisory committee will consist of Maine potato producers, industry professionals, staff from the University of Maine and UMaine Extension, as well as others determined necessary as the project develops. After the completion of each year of the project, surveys will be sent out to growers and industry professionals to evaluate the resulting research and educational components of the project.

IX. Project Commitment:

The following partners commit to work together to ensure the goals and outcome measures outlined in the proposed project come to fruition:

- Donald Flannery, Executive Director, Maine Potato Board
- Timothy Hobbs, Director of Grower Relations, Maine Potato Board

- George McLaughlin, Agricultural Engineer, Maine Potato Board
- Andrew B. Plant, Ag Educator, UMaine Extension
- James D. Dwyer, Crop Specialist, UMaine Extension
- John Jemison, Soil and Water Specialist, UMaine Extension
- Leigh Morrow, Director of Agronomy, McCain Foods, Easton, ME
- Erica Fitzpatrick-Peabody, Field Agronomist, McCain Foods, Easton, ME
- Keith LaBrie, Labrie Farms, St. Agatha, ME
- Brent Buck, Buck Farms, Mapleton, ME
- Matthew Porter, Porter Farms, Mapleton, ME
- Gregg Garrison, Double G Farms, Bridgewater, ME

Additional stakeholders in this project are: The University of Maine Cooperative Extension, Maine Department of Agriculture, Natural Resources Conservation Service as well as the Soil and Water Conservation Districts in Aroostook County.

MAINE POTATO INTEGRATED PEST MANAGEMENT

II. ABSTRACT

The management of insects, diseases, and other pests is integral in sustaining the \$500 million Maine potato industry. Without reliable and sustainable pest management strategies, potato growers face the potential for severe crop losses resulting in significant reductions in profits and threats to long-term viability. To ensure an adequate response to the pest-related hazards confronting potato growers, the University of Maine Cooperative Extension Potato Integrated Pest Management (IPM) Program will provide support through field monitoring, disease forecasting, and distribution of educational materials. The program will employ 10 seasonal aides, maintain 200 specialized insect traps, coordinate a statewide network of electronic weather stations, and survey 75 potato fields on a weekly basis. Applied research regarding late blight spore mortality and fungicide residual will aid in the development of a late blight decision support system and information delivery will be enhanced through the development of a late blight smartphone app. The economic impact of the Potato IPM Program on the Maine potato industry has averaged nearly \$14 million for the past five years. With continued funding this program will provide growers with current information on specific and timely pest management strategies in order to minimize pesticide applications and maximize potato yield.

III. PROJECT PURPOSE

With farm-gate receipts of \$140 million and employment of over 6,000 individuals, Maine's \$500 million potato industry is by far the largest agricultural sector in one of New England's most diverse agricultural systems. Maine potato growers also produce over 10,000 acres of seed potatoes, with a farm gate value of over \$35 million, which are shipped to 26 different states and multiple Canadian provinces. In order to ensure the sustainability and economic viability of Maine's potato industry, timely and efficient management of pests is crucial. The current market demand for perfect, pest and damage-free crops, combined with the public's desire to decrease pesticide use for human health and environmental reasons, creates a difficult challenge for Maine potato growers. 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.

Since 1977, University of Maine Cooperative Extension has been conducting and initiating IPM programs in conjunction with Maine's expanding agriculture industry and the state's growing pest management concerns. Information gathered through multiple sources, including direct observation, trapping, weather data, and predictive modeling, is delivered to stakeholders in Maine and throughout the region via electronic and standard newsletters, websites, and telephone message centers. The Potato IPM Program maintains nearly 200 specialized insect traps,

coordinates a statewide network of electronic weather stations, and surveys 75 potato fields on a weekly basis for weeds, insects and diseases. The data produced helps 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. Since its inception, the Potato IPM Program has strived to adapt to the changing needs of the potato industry. Historically, the Potato IPM Program has modified its course of action in response to emerging pest threats, including Colorado potato beetle pesticide resistance, the occurrence of European corn borer as a potato pest, novel strains of potato late blight, and the appearance of recombinant strains of PVY.

With the advent and extensive transportation of new late blight clonal populations, both the Potato IPM Program and Maine's potato growers must continually modify late blight management strategies. Tiers relating to distance from late blight inoculum sources have been developed to provide geographic context to management plans, however these tiers are in need of further refinement and development. Utilization of a tiered IPM approach has slowed the onset of late blight into Maine by two to three weeks on average, translating to millions of dollars in savings and thousands of pounds in fungicide reduction. To ensure that late blight IPM continues to advance both functionally and technologically, new approaches to data management are imperative. The next generation of late blight IPM prediction and management is a decision support system (DSS) which aids in the compilation of both raw data and models to guide the decision making process. A late blight DSS is a complex computer model that analyzes and weighs multiple factors including crop growth, distance to inoculum, harvest dates, and predicted future weather patterns to provide a strengthened framework to late blight management modeling.

This proposal describes years two and three of an awarded three-year project intended to continue the field-monitoring program that has imparted millions of dollars of savings into the Maine potato industry while also moving the Potato IPM Program forward technologically through the creation of a DSS for late blight IPM prediction and management. The combination of field surveys and the use of a DSS to interpret rapidly changing factors, including weather, crop growth, inoculum loads, fungicide residual, and spore mortality, will provide potato growers and researchers with an unprecedented look at the evolving pest dynamics pertaining to Maine's largest crop. The enhanced IPM research and educational outreach associated with this proposal align perfectly with the objectives set forth in the Special Priority Areas designated by the USDA. **This project has not been funded by another Federal or State grant program.**

IV. POTENTIAL IMPACT

The Potato IPM Program impacts all of Maine's 400 commercial potato growers and their approximately 59,000 acres of potatoes as well as a multitude of backyard gardeners. The program also has a broader impact on national and international growers who rely on Maine's valuable seed crop. Information generated from the Potato IPM Program is disseminated through multiple media platforms throughout the nation and to approximately fifty different countries. The enhanced IPM research and education resulting from this program provides growers with a science based decision making process that can potentially reduce production costs through

decreased pesticide applications and, through the use of effective monitoring techniques, can ultimately save growers millions of dollars in potential crop losses.

Pressure from insect pests such as European corn borer, aphids, flea beetles, Colorado potato beetle, potato leafhopper, and cutworms make the continuation of an intensive Potato IPM Program in Maine a necessity. The soybean aphid has been a concern for soybean and canola producers in the state, and is increasingly becoming an issue for potato growers. It was discovered in Maine during the fall of 2004 and was subsequently found in 2005, 2006, 2007, and in 2012, thus indicating its ability to over-winter in Maine. Due to the soybean aphid's ability to transmit PVY, it has the capability to become a significant potato pest. During the 2012 growing season in Maine, aphid populations were more active than in recent years. Four major potato-colonizing species of aphids, including green peach aphid, buckthorn aphid, and potato aphid were detected. Additionally, non-colonizing aphid species such as black bean aphid, English grain aphid, and bird cherry oat aphid, have been collected in Maine potato fields. Both the colonizing and non-colonizing aphids have the potential to contribute greatly to the spread of PVY.

PVY is a major agricultural disease that has the potential to drastically reduce crop yields and has become a significant issue for the North American potato industry. PVY can be transmitted from aphid to plant in a matter of seconds, rendering traditional insecticides ineffective. New strains of recombinant PVY have completely displaced the ordinary strains in Europe and are becoming increasingly abundant in Maine. These recombinant strains seem to be transmitted more efficiently and do not tend to display visual symptoms as clearly as the traditional PVY strain. The recombinant strains can also cause internal flesh discoloration in some potato varieties as well as necrotic ringspot. The presence of PVY can have serious implications for Maine's seed potato industry. In 2012, Maine, New Brunswick and Prince Edward Island all experienced significant elevations in their PVY levels and over 10% of Maine's potato seed lots were rejected from seed certification due to PVY. Management of this non-persistent aphid vectored virus is a critical priority for potato growers and the Potato IPM Program.

Late blight continues to be one of the most significant and potentially devastating diseases impacting the Maine potato industry. In 2009, a nationwide late blight epidemic infected potato crops throughout the U.S. and Canada. The Maine potato industry faced a distinct threat as late blight spread north through the eastern states and south from bordering Canadian Provinces. This new strain of late blight, which still remains an issue in Maine, threatened to cause severe crop losses. Through the implementation of the Potato IPM Program's computerized disease forecasting system NoBlight, fungicide recommendations, field monitoring, early detection, and appropriate management outreach, growers were able to successfully manage the unprecedented late blight pressure. It has been estimated that the value of the program impact to the Maine potato industry exceeded \$26 million dollars for the 2009 growing season and helped to decrease late blight risk for the 2010 growing season.

Dry conditions during the latter portion of the 2012 season helped to decrease late blight threats and through the use of the NoBlight model, fungicide applications were reduced. Over the past five years, the NoBlight forecasting model has saved Maine potato growers two to four fungicide applications annually per grower. Respondents of a year-end grower survey reported saving over

\$2,000 per year from using the information. The reductions in fungicide applications and grower savings have made the NoBlight forecasting system a valuable and successful tool for late blight prediction and management in Maine.

In response to the potato industry's changing pest dynamics, the multifaceted Potato IPM Program continues to evolve and has had a significant impact on Maine potato growers as well as other potato producing areas. During the 2012 growing season, the Potato IPM program made 3,000 individual personal grower contacts. The Potato Pest Management Hot Line received 1,500 calls from producers and technical field staff for pest updates. Information regarding potato pest information was posted on two websites and was viewed by over 7,600 computers from fifty different countries. A weekly newsletter with current regional pest updates was also emailed to approximately 350 industry staff and another 450 newsletters were U.S. mailed to individuals. The total economic impact of the Maine Potato IPM Program for 2012 was \$7,448,500, an approximately 48 to 1 return on investment. In addition to the program's economic impact, pesticide applications were reduced by an estimated 47,776 gallons.

V. EXPECTED MEASURABLE OUTCOMES

GOAL #1: An expected measurable outcome of this project is increased grower knowledge of potato pest issues and associated pesticide risks.

BENCHMARK: This outcome is based upon benchmark data from grower records, pre-season grower surveys, and from information gathered through the Potato IPM Program during the previous growing seasons. This information provides a look at previous pest issues, the management strategies employed, as well as information regarding crop yield and quality.

TARGET: A 20% increase in grower knowledge regarding effective, economic, and environmentally sound pest management strategies in order to maximize the quality and yield of the Maine potato crop.

PERFORMANCE MEASURES: Evaluation of this measurable outcome will be based upon a year-end program participant survey to quantify the effectiveness of the educational and practical components of the program. In addition, grower records and spray logs will be compared to identify effective management strategies and to determine the relationship between these strategies and crop yield/quality.

GOAL #2: Increased implementation of IPM strategies among program participants

BENCHMARK: This outcome is also based upon benchmark data which comes from grower records and pre-season grower surveys. This information provides statistics regarding the number of growers currently employing IPM strategies.

TARGET: Program participants will increase implementation of recommended IPM strategies by 10%.

PERFORMANCE MEASURES: Evaluation of this measurable outcome will be based upon a year-end program participant survey to quantify the increase in IPM implementation.

Outcome Timeline

What	When
Increased grower knowledge of pest issues and pesticide risks	September 2015, 2016
Increased implementation of IPM in the potato industry	September 2015, 2016
Completion of fungicide decay model	September 2015
Creation of a comprehensive late blight IPM decision support system	September 2016

Additional Objectives

- Effective response to potato pest problems through:
 - Insect identification
 - Disease identification
 - Weed identification
- Modernization of late blight management decision-making protocol
- Increase grower knowledge of pesticide risks (environmental and personal risks)
- Increase potato pest knowledge base through enhanced applied research efforts
- Reduce risks to people and the environment through minimized pesticide use
 - Help growers use pesticides safely and judiciously
- Utilize relevant University of Maine Extension web-based resources

VI. WORK PLAN

In order to assist growers in their attempts to alleviate pest pressures, the University of Maine Cooperative Extension's Potato IPM Program provides multiple services ensuring that growers have access to pertinent potato pest management information. The program will employ 10 seasonal program aides, pay partial salaries for one professional and two classified employees, coordinate the deployment and maintenance of nearly 200 specialized insect traps, coordinate a statewide network of electronic weather stations, and survey 75 potato fields on a weekly basis for weeds, insects and diseases. This level of field monitoring will lead to improved insect and disease identification, computerized late blight forecasting to improve fungicide scheduling, and will provide growers with current information on specific and timely treatments in order to minimize the number of pesticide applications and maximize potato yield.

To facilitate widespread adoption of IPM practices, educational programs will continue to be implemented through the University of Maine Cooperative Extension Potato IPM Program in 2014 and beyond. Specific information regarding management of insect and disease pests, bruise reduction, and storage management will be provided. As a result of the growing threats from PVY, detection, identification, and management of both colonizing and non-colonizing aphids will be a priority. Due to their limited persistence in potato fields, field monitoring for non-colonizing aphids is nearly impossible. In order to track these virus vectors, a series of specialized aphid traps will be deployed in potato seed fields. Due to recent changes in pesticide products and use, secondary insect pests such as European corn borer, cutworm, potato leafhopper, white grub, and potato flea beetle have become important pests. Therefore, an increased educational effort concerning these insects will be continued.

Applied research on late blight and other potato diseases is critical in maintaining an effective potato IPM program. Developing the established late blight prediction system into a decision support system (DSS) with the addition of specific fungicide characteristics, a fungicide decay model, location of inoculum parameters, and spore mortality will take late blight IPM to the next level. To reach the goal of a comprehensive late blight DSS, a number of inputs must be calculated. Proposed is the construction of a rain simulator to quantify fungicide residual after rain events of varying duration and intensity. This quantification of fungicide residual will lead to the development of a fungicide decay model. In conjunction with predicted future weather, growers could utilize this information to determine if a fungicide application is needed, when to best target applications, rate of material, and choice of material. Another necessary input for late blight prediction is spore mortality owing to sunlight. Quantifying the mortality of the pathogen spores with sunlight intensity can help predict spread and development of the pathogen. This will allow better timing of control materials and help predict where control materials are or are not needed.

The distribution of potato IPM information and educational materials to potato growers and other stakeholders ensures proper and effective use of management strategies. An annual Pest Management Conference will be designed and held for field and technical potato industry representatives. An annual Potato Conference designed for growers will also be held in order to discuss the previous growing season and strategies for improving the future of the potato industry. Monthly trainings for field/technical support staff will be held in addition to the annual Scout School and Rogueing School. Grower/producer training sessions will also be held during the winter months to discuss pest issues and the implementation of IPM techniques into grower operations. Newsletters, websites, and telephone hotlines will be consistently updated to provide growers with timely information. In addition to the traditional methods of information delivery, the advent of smartphone technology has opened the door for rapid, instantaneous distribution to a wide audience. Development of a smartphone app is proposed to aid in the modernization of late blight IPM delivery.

Evaluation and monitoring of the expected measurable outcomes is conducted through year-end participant surveys, online feedback regarding the program's websites and electronic newsletters, and through meetings with growers and stakeholder groups. Grower survey's quantifying IPM implementation, crop yield, pesticide use, profitability, and participant knowledge of IPM

strategies can illustrate the project's strengths and weaknesses, direct future goals, and be used in the development of educational materials and workshops.

Work Plan Timeline

Proposed Activities	Personnel Involved	Timeframe
Hold annual Pest Management Conference for field and technical potato industry representatives	James Dwyer, Griffin Dill, Steve Johnson, Sean McAuley, James Dill	December 2014, 2015
Hold annual Potato Conference to discuss relevant potato pest issues and general potato crop information	James Dwyer, Griffin Dill, Steve Johnson, Sean McAuley, James Dill	January 2014, 2015
Gather Benchmark data through grower surveys, grower records, and spray logs	James Dwyer, Griffin Dill, Sean McAuley, James Dill	February - May 2015, 2016
Hold Scout School and Rogueing School	James Dwyer, Griffin Dill, Sean McAuley, James Dill	June 2015, 2016
Deploy specialized insect traps and coordinate weather stations	James Dwyer, Griffin Dill, Sean McAuley, Seasonal Program Aides	June 2015, 2016
Survey potato fields weekly for pest issues	James Dwyer, Griffin Dill, Sean McAuley, Seasonal Program Aides, James Dill	June-September 2015, 2016
Monitor chain retailers for late blight infected plants and identify any suspected problems	James Dwyer, Griffin Dill, Sean McAuley, James Dill	May-September 2015, 2016

Hold monthly trainings for field/technical support staff	James Dwyer, Griffin Dill, Steve Johnson, Sean McAuley, James Dill	June-September 2015, 2016
Identification of specimen samples	James Dwyer, Griffin Dill, Sean McAuley, James Dill	September 2015
Collect data to evaluate performance measures	James Dwyer, Griffin Dill, Sean McAuley, James Dill	November - March 2015, 2016

VII. BUDGET/BUDGET NARRATIVE

BUDGET		
OBJECT CLASS CATEGORIES	YEAR 2	YEAR 3
a. Personnel	\$76,638	\$76,638
b. Fringe Benefits	\$18,864	\$18,937
c. Travel	\$16,516	\$16,516
d. Equipment	0	0
e. Supplies	\$12,982	\$12,909
f. Contractual	0	0
g. Construction	0	0
h. Other	0	0
i. Total Direct Charges	\$125,000	\$125,000
j. Indirect Charges	0	0
k. TOTALS	\$125,000	\$125,000
PROGRAM INCOME		

A. Personnel

Three months of salary will be used for an IPM Professional to help with all aspects of the Potato IPM Program in the Presque Isle and Orono offices, including gathering benchmark data, providing on-site IPM support to potato growers, identifying specimen samples, producing educational publications, and planning/holding training sessions and conferences. Three months of salary will be used for a Scientific Research Specialist to work from the Orono office on insect trapping, field monitoring, and staff training. Nine months of salary will be used for a Scientific Technician to work in the Presque Isle office on the construction and maintenance of a rain simulator, quantification of late blight spore morality, and the development of late blight smartphone applications.

Ten temporary summer employees will be needed to survey area potato fields in order to implement the program. Summer employees will be monitoring approximately 75 fields in order to assist Maine potato producers in the adoption of IPM techniques, with an emphasis on late blight control. Employees will provide information on the operation of disease forecasting equipment and other pest information. These employees will gather information that entails entering over 1.5 million data points into our computer data storage and forecasting system. These student workers work an average of 12 weeks at approximately \$8.35 per hour for a 40-hour week.

IPM Professional (3 months)	
Requested amount	\$ 8,493
Scientific Research Specialist (3 months)	
Requested amount	\$ 7,842
Scientific Technician (9 months)	
Requested amount	\$ 20,223
Undergraduate Students	
Ten Seasonal Program Aides (\$8.35/hr x 4,800 hrs)	
Requested amount	\$ 40,080
	Subtotal.....
	\$ 76,638

B. Fringe Benefits

IPM Professional (3 months)	
Requested Fringe (at 51.6%)	\$ 4,382
Scientific Research Specialist (3 months)	
Requested Fringe (at 51.6%)	\$ 4,047
Scientific Technician (9 months)	
Requested Fringe (at 51.6%)	\$ 10,435
	Subtotal.....
	\$ 18,864

*For year three of this multiyear award, the fringe benefit rate will be adjusted to 51.8%, resulting in a total fringe benefit increase of \$73. This amount will be subtracted from the requested supplies for year three.

C. Travel

Seasonal Extension employees will be operating from Fort Kent, Maine to Palmyra, Maine, which lie approximately 300 miles apart. The IPM program will operate 5 vehicles for personnel transportation. We are allotting approximately 6,134 miles per vehicle (2x4 pickup) at the University of Maine Motor Pool rate of \$0.27 per mile with a \$27.45 daily charge.

1. Mileage (\$0.27 per mile, \$27.45 daily charge x 5 vehicles)..... \$ **16,516**

D. Equipment..... (none)

E. Supplies

Approximately 75 potato fields will be surveyed once per week and on-site weather monitoring equipment and insect traps will be checked twice per week from early June through August. As a minimum, each farm site to be surveyed by the data collectors will have the following equipment located at the site:

- 1 water yellow pan insect trap
- 1 hard board base for insect trap
- 1 rain gauge

Some sites where secondary pest problems are emerging will also have:

- European corn borer pheromone traps
- Black cutworm pheromone traps
- Variegated cutworm pheromone traps
- Other monitoring equipment as required
- Aphid cards

Lab supplies including petri dishes, agar plates, slides, beakers, and pipettes will be utilized in the identification and applied research of potato diseases. Additionally, supplies including pumps, nozzles, piping, and framing materials, will be used in the construction of a rain simulator.

Field Supplies (Year 2)

Plastic Pans for aphid traps (60 pans at \$18 per pan).....	\$1,080
Yellow Paint for aphid traps (5 gallons at \$25 per gallon).....	\$ 125
Paint Brushes – 2” wide (4 brushes at \$5 per brush).....	\$ 20
4x4 Hardboard Sheets (61 sheets at \$7 per sheet).....	\$ 427
Rain Gauges (60 gauges at \$8 per gauge).....	\$ 480
Yellow Sticky Cards (1,000 cards).....	\$ 254
Heliothis Traps (5 traps at \$52 per trap).....	\$ 260
Winged Cardboard Sticky Traps (2 cases of 25 at \$53 per case).....	\$ 106
European Corn Borer IA and NY Pheromone (5 packs of 10 at \$17 each).....	\$ 170
Black Cutworm Pheromone (30 lures at \$2.50 per lure).....	\$ 75
Variegated Cutworm Pheromone (30 lures at \$2.50 per lure).....	\$ 75

Ethyl Alcohol 90% (5 gallons at \$6 per gallon).....	\$ 30
Dish Detergent (3 56 ounce bottles at \$6 per bottle).....	\$ 18
Mini Aphid Brushes (1 pack of 25).....	\$ 5
Sample Vials (4 packs of 100).....	\$ 200
Aphid Vials (2 packs of 500 at \$60 per pack).....	\$ 120
Polycarbonate Sample Bags (1 pack of 500).....	\$ 62
Re-sealable Sample Bags (6 packs of 50 at \$5 per pack).....	\$ 30
Coolers (4 coolers at \$15 per cooler).....	\$ 60
Hand Lenses (8 hand lenses at \$4 per lens).....	\$ 32
Rain Jackets (15 jackets at \$40 per jacket).....	\$ 600
Rain Pants (15 pairs at \$36 per pair).....	\$ 540
Over-Boots (15 pairs at \$25 per pair).....	\$ 375
Disinfectant (5 gallons at \$55 per gallon).....	\$ 275
Handheld Sprayers (7 sprayers at \$50 per sprayer).....	\$ 350
Scrub Brushes (7 brushes at \$4 per brush).....	\$ 28
Portable Decontamination Kits (4 kits at \$115 per kit).....	\$ 460
Disposable Nitrile Gloves (13 cases at \$100 per case).....	\$1,300
Insect Repellent (7 cans at \$5 per can).....	\$ 35
Sunscreen (6 bottles at \$5 per bottle).....	\$ 30
Fire Extinguishers (8 fire extinguishers at \$18 each).....	\$ 144
Weather Stations (2 stations at \$1,000 each).....	\$2,000
Solar Radiation Sensor.....	\$ 278

Lab Supplies (Year 2)

Microscope Slides (5 boxes of 144 at \$50 per box).....	\$ 250
Coverslips (1 box of 1,000).....	\$ 40
Disposable Graduated Pipettes (1 box of 500).....	\$ 88
Petri Dishes (3 cases of 500).....	\$ 750
Petri Plate Case (8 cases at \$125 each).....	\$1,000
Specialty Agar Mix (2 pounds at \$155 per pound).....	\$ 310
Agar (5 pounds at \$100 per pound).....	\$ 500

Total (Year 2).....\$12,982

Field Supplies (Year 3)

Plastic Pans for aphid traps (60 pans at \$18 per pan).....	\$1,080
Yellow Paint for aphid traps (5 gallons at \$25 per gallon).....	\$ 125
Paint Brushes – 2” wide (4 brushes at \$5 per brush).....	\$ 20
4x4 Hardboard Sheets (59 sheets at \$7 per sheet).....	\$ 413
Rain Gauges (60 gauges at \$8 per gauge).....	\$ 480
Yellow Sticky Cards (1,000 cards).....	\$ 254
Heliothis Traps (5 traps at \$52 per trap).....	\$ 260
Winged Cardboard Sticky Traps (2 cases of 25 at \$53 per case).....	\$ 106
European Corn Borer IA and NY Pheromone (5 packs of 10 at \$17 each).....	\$ 170
Black Cutworm Pheromone (30 lures at \$2.50 per lure).....	\$ 75

Variegated Cutworm Pheromone (40 lures at \$2.50 per lure).....	\$ 100
Ethyl Alcohol 90% (5 gallons at \$6 per gallon).....	\$ 30
Dish Detergent (3 56 ounce bottles at \$6 per bottle).....	\$ 18
Mini Aphid Brushes (1 pack of 25).....	\$ 5
Sample Vials (4 packs of 100).....	\$ 200
Aphid Vials (2 packs of 500 at \$60 per pack).....	\$ 120
Polycarbonate Sample Bags (1 pack of 500).....	\$ 62
Re-sealable Sample Bags (6 packs of 50 at \$5 per pack).....	\$ 30
Coolers (4 coolers at \$15 per cooler).....	\$ 60
Hand Lenses (10 hand lenses at \$4 per lens).....	\$ 40
Rain Jackets (15 jackets at \$40 per jacket).....	\$ 600
Rain Pants (15 pairs at \$36 per pair).....	\$ 540
Over-Boots (15 pairs at \$25 per pair).....	\$ 375
Disinfectant (5 gallons at \$55 per gallon).....	\$ 275
Handheld Sprayers (5 sprayers at \$50 per sprayer).....	\$ 250
Scrub Brushes (7 brushes at \$4 per brush).....	\$ 28
Portable Decontamination Kits (4 kits at \$115 per kit).....	\$ 460
Disposable Nitrile Gloves (14 cases at \$100 per case).....	\$1,400
Insect Repellent (7 cans at \$5 per can).....	\$ 35
Sunscreen (6 bottles at \$5 per bottle).....	\$ 30
Fire Extinguishers (8 fire extinguishers at \$18 each).....	\$ 144
Pump for rain simulator.....	\$1,123
Nozzles for rain simulator (24 nozzles at \$10 per nozzle).....	\$ 240

Lab Supplies (Year 3)

Microscope Slides (5 boxes of 144 at \$50 per box).....	\$ 250
Coverslips (1 box of 1,000).....	\$ 40
Disposable Graduated Pipettes (2 boxes of 500).....	\$ 176
Petri Dishes (3 cases of 500).....	\$ 750
Petri Plate Case (11 cases at \$125 each).....	\$1,375
Specialty Agar Mix (4 pounds at \$155 per pound).....	\$ 620
Agar (5.5 pounds at \$100 per pound).....	\$ 550

Total (Year 3)..... \$12,909

F. Contractual..... (none)

G. Construction..... (none)

H. Other..... (none)

I. Total Direct Charges \$125,000

J. Indirect Charges.... (none allowed)

K. Total Request \$125,000

VIII. PROJECT OVERSIGHT

Evaluation of the Maine Potato IPM Program is accomplished in several ways. The Maine Potato Board, in conjunction with Cooperative Extension Administration and the Aroostook County Extension Association will review the progress of each aspect of the program. The review will include an evaluation of how the program has affected the complexity of pest problems on potatoes and the amount of money saved and the amount of pesticides reduced. A written evaluation survey to measure the effectiveness of the educational and practical components of the program will be circulated to program participants as well as newsletter recipients. In addition, the program will be evaluated by the University of Maine Cooperative Extension Potato Advisory Group and other stakeholder groups as determined.

IX. PROJECT COMMITMENT

The following partners commit to work together to ensure the goals and outcome measures outlined in the proposed project come to fruition:

- Donald Flannery, Executive Director, Maine Potato Board
- Timothy Hobbs, Director of Grower Relations, Maine Potato Board
- James D. Dwyer, Crop Specialist, is the program coordinator for potatoes, soybeans, and canola in northern Maine, as well as a member of the Maine/New Brunswick Late Blight Management Task Force.
- Griffin Dill, IPM Professional, aides in the identification of potato pests, conducts research, and makes management suggestions.
- Dr. Steve Johnson, Extension Professor and plant pathologist, coordinates the “No Blight” system, conducts research, and makes management suggestions
- Clay Kirby, Insect Diagnostician, and member of the Maine Vector-borne Disease Work Group and the Entomology Ad Hoc Committee of the National Plant Diagnostic Network and staffs the University of Maine Extension Pest Diagnostic Facility.
- Dr. Bruce Watt, Plant Disease Diagnostician, coordinates Maine’s National Plant Diagnostic Network activities and staffs the University of Maine Extension Pest Diagnostic Facility.
- Dr. James F. Dill, University of Maine Extension Pest Management Specialist and Director of the University of Maine Extension Pest Diagnostic Facility, is responsible for overall integrated pest management program administration as well as implementation of the Potato IPM Program in central Maine.
- Sean McAuley, Scientific Research Specialist, is the field monitoring crew supervisor for the central Maine Potato IPM Program.
- Pamela Hickey and Meghan Dill will provide secretarial/clerical support to help with mailings and other office-related activities for the program.

Project Title - Enhancing the Competitiveness of New England Specialty Crops through Regional Collaboration

Abstract

The Harvest New England Association, Inc., (HNE), established in 1992, is the only regional marketing association comprised of the New England State Departments of Agriculture. This wholesale-driven project, completed over three years, has three components which work towards the overall goal of increasing purchases and sales of regional specialty crops by New England wholesalers and increased awareness of regional specialty crops by consumers.

Component 1, Producer Education: 2015 and 2017 Harvest New England Agricultural Marketing Conference and Trade Show.

Component 2, Consumer Education: Passport to New England during the 2015, 2016, 2017 Harvest New England Day at the Big E.

Component 3, Producer Buying Opportunities: Wholesale Matchmaking throughout New England.

The projects are responding to needs expressed by the industry and the continued need for consumer education on the availability of New England grown specialty crops. The importance of regional wholesale buying for the purposes of sales to school, institutions, and restaurants is ever present and an increasing priority for each of the New England states. Producers, consumers, and wholesalers now need the education and the knowledge to advance to the next level. This will be accomplished by increasing the marketing skills, networking, public awareness, and buying opportunities of New England specialty crops.

Project Partner Organization

Harvest New England through the **Connecticut Department of Agriculture**

Project Oversight

Harvest New England has been a recipient of grant awards since its inception in 1992. To date, 10 grants, both federal and private, have been awarded to the association for various regional projects. HNE and its board members have years of grant experience and have worked on grant-related projects for HNE and their respective states. Our work is also done in partnership with other state and regional agricultural groups. They often have the resources to provide financial assistance when non-specialty crop producers have the potential to benefit. The experience within the board and partnership with other industry associations reaffirms the likelihood of success for the proposed projects.

Project Purpose

Schools, hospitals, restaurants, and other institutions are more conscious about where the food they're serving is sourced from. Consumers are demanding local food and transparency about where their food is grown. State and federal contracts are including language which stress the importance of buying local or regional food before buying nationally or even internationally. To meet those demands and requirements schools, institutions, and restaurants are looking to purchase more regional specialty crops but are struggling to do so. This is an area of purchasing which is becoming more and more important yet harder to accomplish.

From an industry perspective, producers are hungry for and always say there is a need for education and educational opportunities. Evaluations from previous HNE conferences reinforce this desire. Direct buying and one-on-one meetings with buyers are very uncommon but are expected to be positively received by the industry.

This project looks to break down the barriers to regional specialty crop purchases at the wholesale level by:

Component 1, Producer Education: educating producers on how to establish connections with and respond to the requirements of wholesale buyers at the 2015 and 2017 Harvest New England Agricultural Marketing Conference and Trade Show

Component 2, Consumer Education: educating consumers during HNE Day at the 2015, 2016, and 2017 Big E, New England's largest agricultural exposition, on the importance of regional food, where they can source it, and the importance of demanding it. This will be accomplished through the *Passport to New England* where consumers, both adults and children, will have an opportunity to learn about New England specialty crops by engaging in agricultural trivia in each state building and entering to win a prize donated by each state.

Component 3, Producer Buying Opportunities: connecting wholesaler buyers with wholesale specialty crop producers through five one-on-one matchmaking meetings throughout the region.

It will be ensured that funding will solely benefit specialty crop producers on all project components in the following ways:

Component 1, Producer Education, 2015 HNE Conference: Grant funds will go towards scholarships which only specialty crop producers are eligible to apply for.

Component 2, Consumer Education, Passport to New England during the 2015 HNE Day at the Big E: Materials will only feature and discuss regional specialty crops, where to source it, and the importance of demanding it.

Component 3, Producer Buying Opportunities: This component will only feature

wholesale buyers of specialty crops and wholesale specialty crop growers.

The USDA encourages projects that develop the local and regional food systems as well as increase child and adult nutrition knowledge and consumption of specialty crops. This project responds to those priority areas through all three components.

Component 1, Producer Education, Harvest New England Ag Marketing Conference and Trade Show was previously funded by the USDA SCBG-FP program.

Overall the conference was extremely well received in 2011 *and* 2013. The survey conducted at the 2013 conference concluded that 78% of respondents said they had an increase in sales as a result of marketing techniques learned at the 2011 and 2013 conference. The focused area in 2011 and 2013 was direct to consumer sales whereas the focus for the 2015 and 2017 conference will be shifted to focus on wholesaling opportunities.

The project above has had great significance to the industry, resulted in a positive impact and change, and is important to the target audience. Through continued funding, HNE has the opportunity to expand educational opportunities beyond direct-to-consumer topics and further develop and expand the project making the impact even more significant to the industry.

While HNE strives to develop projects that are self-sustaining, the association looks to grant funding to keep the overall cost to producers low. The low cost enables a large number of specialty crop producers to take advantage of the project. HNE does not collect dues or have a fee structure for the state associations which limits income, requiring grant funds to be solicited.

This project has not and will not be submitted to or funded by another federal or state grant program.

Potential Impact

As a multistate project the beneficiaries are throughout the involved states and overall region. New England specialty crop producers, wholesalers, institutions, and an estimated 14.3 million New England residents have the potential to be affected by this project.

HNE represents Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont Departments of Agriculture. There are nearly 17,000 specialty crop producers (USDA's New England Agricultural Statistics 2008 Report), over 100 specialty crop wholesalers, and over 460 institutions (state and federal prisons, colleges and universities, and hospitals) throughout New England.

The intended beneficiaries are primarily the specialty crop producers of New England and secondly the wholesalers, consumers, and institutions in New England. The projects proposed

are focused on wholesale marketing and expanding the market to increase the purchase of regional specialty crops. The increased purchases of regional specialty crops will have a direct, positive, effect on New England specialty crop farmers, fostering increased production, overall sales, and increased consumption of New England specialty crops.

There is currently no economic impact data available for this project.

Expected Measurable Outcomes

The overall outcome expected is increased purchases and sales of specialty crops by New England wholesalers. These outcomes will be measured through the New England Agricultural Statics sales numbers.

The projects will accomplish increasing the purchases and sales of New England grown specialty crops by increasing the marketing skills of New England farmers, increasing the demand of New England grown produce by New England consumers, and enabling direct buying opportunities through one-on-one meetings between buyers and wholesalers.

It is acknowledged that the information provided to New England farmers and the outcomes received from the project must extend beyond the immediate audience. The network that exists within the New England state departments of agriculture is one that is hard to match. The relationship that each state department has with the local commodity associations, agricultural nonprofits, and industry trade associations is extensive, allowing the information gathered at a regional level to be disseminated to those at the state and local level. The procedures and outcomes of the proposed projects will be available on the HNE website which also has extensive promotion to various audiences throughout New England.

GOAL: Component 1, Producer Education	To educate producers on how to better market specialty crops through wholesale channels as a result of attending the 2015 and 2017 Harvest New England Agricultural Marketing Conference and Trade Show.
PERFORMANCE MEASURE:	Specific questions on the evaluation form asking if specialty crop producers are better aware of how to work with wholesalers and institutions and market their specialty crop products as a result of attending the conference.
BENCHMARK:	In 2013 78% of respondents said they had an increase in sales as a result of new techniques learned at the conference
TARGET:	At least 78% respondents will report an increase in sales again, though we will strive for 80%.
MONITORING PLAN TO REACH THE TARGETS	A survey will be conducted after each conference. Feedback from the 2015 survey will be assessed and any necessary changes will be implemented for the 2017 conference.
INFORMATION DESSEMINATION	The results and benefits of the conference will be promoted to the specialty crop industry through the HNE website and each of the six state agencies.

GOAL: Component 2, Consumer Education	To increase New England consumer awareness about the availability of New England grown agricultural products through the <i>Passport to New England</i> on HNE Day at the 2015, 2016, 2017 Big E.
PERFORMANCE MEASURE:	The number of consumers who complete the passport during the 2015, 2016, and 2017 Big E and the responses to the follow up survey.
BENCHMARK:	A similar project was done in 2013 and 1,325 people participated.
TARGET:	Consumers will show an increased change in knowledge about New England specialty crops as a result of participating in the passport.
MONITORING PLAN TO REACH THE TARGETS	After the 2015 event, the process will be evaluated and the results of the follow up survey to participants will be reviewed. Changes to the program will be determined for 2016 and 2017 so the outcomes can be achieved.
INFORMATION DESSEMINATION	The results of the passport participation and follow up survey will be disseminated through each of six agencies and through the HNE website.
GOAL: Component 3, Wholesale Match Making Around New England	To increase New England wholesalers awareness and number of purchases of New England grown specialty crops.
PERFORMANCE MEASURE:	The number of wholesalers and New England producers who participate in the one-on-one buying meetings and follow up survey results afterward.
BENCHMARK:	There currently is no benchmark data for this specific event, however once registration is complete we can obtain an understanding of how many of the wholesalers are either buying and distributing New England grown specialty crops and how many producers are currently selling to wholesale houses for regional distribution through a pre-event survey.
TARGET:	There will be a 15% increase in the amount of New England grown product purchased by wholesalers from program participants.
MONITORING PLAN TO REACH THE TARGETS	Materials on how to prepare for the one-on-one meetings will be created and distributed to both the wholesale buyers and specialty crop producers prior to the meeting(s) so both parties can be prepared and come ready to make a sale. Results and outcome of the first meetings will be reviewed and assessed so changes can be made for future meetings.
INFORMATION DESSEMINATION	The overall estimated cash value and number of actual transactions will be shared with the industry in hopes of creating interest for possible future meetings.

Work Plan

Component 1: Producer Education, HNE Ag Marketing Conference and Trade Show

Project Activity	Who	Timeline
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Re-convene industry planning committee to assess past outcomes from previous conferences, organize registration details, create promotional materials, solicit financial sponsors, organize sessions, and develop specialty crop scholarship program	HNE members and industry planning committee	Mid-October 2014
Planning committee meeting to continue activities.	HNE members and industry planning committee	November, December, and end of December, 2014. Early January, end of January, early February, mid February 2015.
Specialty crop scholarship program subcommittee meets to review applications and award scholarships	Specialty crop scholarship subcommittee	Early January 2015
Registration closes		February 14, 2015
Planning committee meeting to wrap up activities.	HNE members and industry planning committee	3 rd week of February 215
Conference February 27-28, 2015	HNE members and industry planning committee	Feb 26-28, 2015
Issue conference evaluation	HNE members	Feb 26-28, 2015
Assess conference evaluation	HNE members and industry planning committee	Month of March 2015
Conduct a debriefing meeting	HNE members and industry planning committee	Month of March 2015
Repeat process above	HNE members and industry planning committee	Starting Fall 2016-February 2017

Component 2: Consumer Education, HNE Day Passport to New England

Project Activity	Who	Timeline
Convene planning committee to organize event logistics with ag expo organization, create the passport, solicit volunteers, create promotional materials, purchase tents, solicit prizes from each state, purchase children's give away.	HNE members and planning committee	June 2015
Planning committee meeting to continue activities.	HNE members	July, August, beginning of September 2015

Conduct event	HNE members and volunteers	September 23, 2015
Compile participant info	HNE members and/or volunteers	Last week of September 2015
Send follow up survey to participants	HNE members and/or	Last week of September 2015
Assess survey responses	HNE members	October 2015
Repeat process above	HNE members	Starting July 2016-October 2016 and again July 2017-September 30, 2017.

Component 3, One-on-One Matchmaker Meetings

Project Activity	Who	Timeline
Convene planning committee to determine dates, locations, and venues throughout New England, develop pre-meeting packet for participants, develop promotional materials, create online registration system, and solicit wholesaler and specialty crop producers.	HNE members and planning committee	June 2015
Planning committee meeting to continue activities.	HNE members	August, September, October, November, early December 2015
First one-on-one buyers meeting, Northern New England	HNE members	Early January 2016
Compile and assess returned evaluations	HNE members	Early Jan 2016
Second one-on-one buyers meeting, Western New England	HNE members	Early of February 2016
Third one-on-one buyers meeting, Eastern New England	HNE members	End of February 2016
Fourth one-on-one buyers meeting, Central New England	HNE members	Beginning of March 2016
Fifth on-on-one buyers meeting, Southern New England	HNE members	Mid-March 2016
Debrief meeting on meetings, evaluate and compile all evaluations	HNE members	End of March 2016

Project Commitment

Harvest New England is committed to this project for the betterment of the specialty crop producers in the respective states. It is supported by other regional groups also working towards increasing consumption of regional specialty crops by institutions throughout New England. Together, as a region, the HNE board can make an impact and increase sales and consumption of regional specialty crops.

Budget Narrative

The total budget for the entire project outlined above is \$36,000. **The amount solicited from the Maine Department of Agriculture, Conservation, and Forestry is \$6,000 or one sixth of the total project.** Each New England state involved Harvest New England Association, Inc. is applying to their respective state’s SCBG program for \$6,000.

The budget outlined below accounts for expenses which the Maine Department of Agriculture, Conservation, and Forestry’s \$6,000 budget will go towards.

Personnel: \$0.00.

Fringe Benefits: \$0.00

Travel: \$250

One-on-One Matchmaking Meeting: \$250

Trip Destination	Purpose of Trip	Type of Expense	Unit of Measure	Number of Units	Cost/Unit	Number of Travelers Claiming Expense	Total Funds Requested for Destination
To meeting venue, Brunswick ME (location TBD)	To facilitate one on one buyer meetings	Mileage	miles	Estimated at 66 miles roundtrip	.56	1	36.96
To meeting venue, Brunswick ME (location TBD)	To meet with wholesale specialty crop growers	Travel Stipend for wholesale buyers	Flat rate	n/a	\$35	6	210

Equipment. \$0.00

Supplies. \$300

One-on-One Matchmaking Meeting: \$300

Item	Justification for Supplies	Cost/Unit	Number of Units Purchased	Total Funds Requested for Supplies
Paper	For pre-meeting preparation materials for wholesaler and specialty crop growers	\$28	3	\$84
Binders	For pre-meeting preparation materials for wholesaler and specialty crop growers	\$6	18 (6 buyers, 12 specialty crop growers)	\$108

Name Tags	For meeting day	\$50	1	\$50
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Consultant/Contractual: \$0.00

Other. \$4,850

Passport to New England during the 2015 HNE Day at the Big E: \$916

An estimated \$916 will go toward the total cost of design and printing of the 2015 Passport.

2015 Harvest New England Conference and Trade Show: \$3,384

This will cover 33 scholarships for specialty crop producers to attend the 2015 conference.

One-on-One Matchmaking Meeting: \$1,150

The matchmaking meetings in Maine will be the first of five sessions throughout New England. As a result the budget will cover the design and a portion of the printing for the promotional item, expected to be a two-sided, four-color postcard which can be brought to meetings or direct mailed to targeted wholesaler and specialty crop growers. A digital format of the postcard will be available for electronic distribution as well.

Indirect costs. \$0.00

Program Income. \$73,275

2015 Harvest New England Conference and Trade Show: estimated at \$73,275

The income is inclusive for income generated from the trade show exhibitors, registration fees, and other solicited financial sponsors. This will be reinvested into the conference to cover audio visual expenses, lunch, and promotions for the conference.

BUDGET	
Object Class Category	
Personnel	\$0.00
Fringe Benefits	\$0.00
Travel	\$250.00
Equipment	\$0.00
Supplies	\$300.00

Contractual Costs	\$0.00
Other Costs	\$4,850.00
Indirect Costs	\$0.00
<i>Project Total</i>	\$6,000.00
Estimated Program Income	\$73,275.00

II. PROJECT TITLE AND ABSTRACT

TITLE: Honeybee Exposure to Pesticides in Maine – The question about Neonicotinoids

ABSTRACT:

Neonicotinoid insecticides are commonly used for control of many insect pests in several important Specialty Crops grown in Maine. These insecticides are relatively inexpensive, highly effective in controlling pests, provide persistent control, and have low human toxicity, as far as known. However, neonicotinoid insecticides are banned in many countries in the European Union (Stafford 2013), some landscapes in Canada, and are considered in some US states for a ban. In fact, in the fall of 2013 a bill was introduced into the Maine legislature to ban neonicotinoids temporarily in Maine. This bill was withdrawn before debate. This class of insecticides has been implicated in honeybee colony collapse and other deleterious effects on honeybees and some native bee declines. Bee pollinators are extremely important to the production of many Specialty Crops grown in Maine, specifically the small fruit, tree fruit and the cucurbit crops. However, the data is far from conclusive that these insecticides are the cause of honeybee declines. This is NOT to say that these insecticides are not harming bees. However, in Maine there is almost NO DATA on the exposure that honeybees experience with neonicotinoid insecticides, or for that matter any pesticides. The intent of this proposal is to collect data on honeybee exposure so that informed decisions can be made regarding bee exposure to neonicotinoid insecticides AND other pesticides in different regions and landscapes in Maine. An informed decision on risk due to pesticides cannot be made without information on potential exposure. Quantifiable exposure rate is the FUNDAMENTAL basis for all toxicological risk assessment.

PROJECT PURPOSE:

Cooperative Extension and The Maine Agricultural and Forest Experiment Station at the University of Maine is requesting \$25,355 in Specialty Crop Block Grant funding for the project, **Honeybee Exposure to Pesticides in Maine – The question about Neonicotinoids**. This project focuses specifically on pest management in Maine specialty crop landscapes and whether there is a potential danger to honeybees in these landscapes to NEONICOTINOID insecticides as well as other pesticides. In addition, TWO of the USDA objectives suggested by the AMS (USDA/Agricultural Marketing Service) for the specialty crop agricultural industry are addressed: d) Developing “Good Agricultural Practices”, “Good Handling Practices”, “Good Manufacturing Practices”; and h) Pest and disease control.

This project will address a global, national and now a Maine issue about pollinators. Are honeybees, arguably our most important pollinator of Maine’s fruit and vegetable crops, being exposed to high levels of neonicotinoid insecticides as a by product of IPM (integrated pest management)? In addition, this proposal is requesting funds to measure all other common pesticide exposure (175 chemical compounds) in order to frame this question in a relevant way, meaning that we want to assess potential exposure to neonicotinoid insecticides relative to the potential risk of other pesticides AND we want to evaluate the potential exposure risk to honey bees in MAJOR “Specialty Crops” grown in Maine: wild blueberries, apples, and potatoes; RELATIVE to the homeowner residential landscape as well as the urban landscape and the “natural pristine” landscape in Maine.

Neonicotinoid insecticides are an important integrated pest management tool in Specialty Crops that have low human toxicity. There is currently a move to BAN this group of insecticides and potentially others in Maine. A bill was submitted (and later withdrawn) to the Maine State Legislature last session (fall 2013) and other bills could follow in the near future.

UNFORTUNATELY, we currently have almost NO DATA on what HONEY BEE EXPOSURE to this chemical class of insecticides (neonicotinoids) is or for that matter any of the pesticides that farmers and homeowners currently use in Maine.

This grant proposal requests funding to provide the necessary minimal set of information that can be used for making informed decisions by Maine's state agencies and legislature. This proposal has NOT and WILL NOT be submitted to any other state or federal agency or funding organization for funding.

III. POTENTIAL IMPACT:

It is difficult to estimate an impact on pesticide exposure to honeybees and other pollinators. Nationally it is estimated that honeybees contribute about \$15 billion in agricultural value (Calderone 2012). In Maine, many significant crops are entirely dependent upon bee pollination such as wild blueberries, raspberries, apples, and cucurbit crops (squash, pumpkin, cucumbers, etc.). In addition, there are several crops that are partially dependent upon bees and other pollinators such as strawberries and pears. This combined crop agriculture involves more than 2,616 farms in Maine accounting for 42% of all agricultural sales in Maine (Anonymous 2012). Therefore, even a small reduction in pollinators due to pesticide exposure could result in an economic cost to Maine's farmers. In addition, honeybees and other pollinators are responsible for the maintenance (through pollination) of many of our deciduous forest trees, spring wild flowers, and summer meadow flowers. A detrimental effect on pollinators in the future is difficult to quantify in dollar terms for Maine's natural plant communities.

But, also at risk is a loss of an important group of insecticides, if a ban were to take place. A hardship for some growers, especially if this ban were not necessary. Neonicotinoid insecticides are important tool in potato (a non-dependent pollinator crop), blueberry, apples, and many vegetables. In some crops there are alternative insecticides that could be used (albeit, possibly more expensive) and in other crops there is not a current alternative other than some of the older insecticides such as carbamates and organophosphates that the USEPA is trying to phase out of US agricultural production (Sudakin and Power 2007).

The neonicotinoid insecticides may be quite harmful to bees (Decourtye and Devillers 2010, Cresswell et al. 2012, Drummond 2012d), however, the data on this topic is contradictory (Cresswell 2011, Blacquiere et al. 2012, Drummond 2012a, 2012b, 2012c) and many of the experiments that could provide evidence of detrimental effects have not been performed using "REALISTIC FIELD EXPOSURE RATES" that bees encounter. For instance, a very recently published experiment on the effects of two neonicotinoid insecticides on honeybees fed the bees for 13 weeks straight with contaminated sugar syrup (Lu et al. 2014). The authors found highly significant effects when honey bees were fed neonicotinoids over a prolonged time period, but this is hardly surprising as neonicotinoids are insecticides designed to kill insects. The effects of neonicotinoid insecticides and OTHER pesticides on bee health may take a lengthy time to determine. It has been shown that insecticides have a variety of subtle modes of actions on

honeybees and other bees that can be difficult to detect or difficult to determine the actual long-term effects of exposure. For instance, the neonicotinoid imidacloprid, has been shown to affect cognitive abilities of honeybees and bumble bees (Medrzycki et al. 2003, Mommaerts et al. 2010). This results in reduced ability to navigate back to the colony and also a reduced foraging rate on flowers (Decourtye et al. 2004a, 2004b). These effects can occur at extremely low exposure concentrations due to the incredible biological activity that these insecticides have on insects. Levels between 20 and 50 ppb (parts per billion) can result in cognitive impairment. Brain development can also occur in honeybee exposure to neonicotinoids (Dobrin et al. 2011). Other more complex effects have been documented such as synergy between neonicotinoid insecticides and honeybee and bumble bee pathogens (Pettis et al. 2012) or synergy between neonicotinoid insecticides and other classes of insecticides when simultaneous exposure occurs (Furlong and Groden 2001). Hundreds of studies have been published on neonicotinoid effects on bees and the effects are almost as numerous (Goulson 2013). However, these effects are not solely a response to neonicotinoid insecticides, several sub-lethal interactions have been documented with other pesticides (Claudianos et al. 2006, Brittain and Potts 2011).

What is exposure and how can it be measured? Exposure is simple the dose (concentration per unit of body mass) of a toxicant over a period of time. Exposure can occur through: 1) the body exterior or skin (**dermal or in the case of an insect, cuticular/integumental**), 2) the atmosphere during breathing (**inhalation**), or 3) feeding or drinking (**oral**). Exposure in honeybees occurs through all three of these routes. However, it is generally agreed upon that the immature stages of honeybees (larvae or brood) are MORE sensitive to pesticides, ie. require a lower dose for detrimental effects to result (Pettis et al. 2013). Because of this, larval food which is pollen mixed with nectar (bee bread) can be considered a significant route of exposure for the honeybee colony. Pollen being brought back to the hive is a major constituent of bee bread and can be easily measured (Drummond et al. 2012). Pollen traps are devices that sample pollen from returning workers having pollen loads in their corbiculae (pollen baskets). Using pollen traps one can have honeybee foragers sample the environment for pollen, on average in a 12 square mile area around a colony. Quantitative chemical analysis of this sampled pollen can allow an accurate estimate of daily exposure. Drummond et al. (2012) have related exposure levels in trapped pollen to colony survival and queen supercedure rates. ***WE PROPOSE POLLEN TRAPPING HONEYBEE COLONIES ACROSS SIX LANDSCAPES THROUGHOUT MAINE TO QUANTITATIVELY MEASURE TOTAL PESTICIDE EXPOSURE.***

IV. EXPECTED MEASURABLE OUTCOMES:

This project will develop a database of honeybee exposure, based upon pollen trapping, for six landscapes throughout Maine. This database will be comprised of pesticide and breakdown metabolites quantified in trapped pollen for the six landscapes in each of 5 locations within each landscape. Specific stakeholder outcomes will be (see Table 1 below):

1. Database of honeybee exposure with regional and landscape relevance
2. Scientific Journal Article written and submitted for publication
3. Agency Report written and published by the Board of Pesticide Control with assistance from Dr. Frank Drummond
4. Presentations of results to Maine legislators, beekeepers, growers, and the general public

Table 1. Measurable outcomes or deliverables from proposed honeybee exposure study.

Timeline	Exposure Outcomes
Fall / Winter 2014	1. Purchase pollen traps, collecting vials for pollen, reserve rental car for visiting sample apiary sites in spring and summer 2015, contact beekeepers across the state for assistance in hive use for pollen trapping.
Spring, Mid-Summer 2015	2. Travel throughout state to provide beekeepers with pollen traps and collecting vials. Send collected pollen to Connecticut Agricultural Experiment Station for Chemical Analysis
Late Summer, Fall 2015 and Winter and Spring of 2015/2016	3. Upon receipt of chemical analysis, summarize and statistically analyze data and write BOTH a scientific manuscript and an educational report for the legislature, state agencies, farmers, beekeepers, and the general public. Also provide information in presentations made by the Board of Pesticide Control and the University of Maine Cooperative Extension.

The number of individuals that are reached by this project will be determined by publishing the results in the Maine State Beekeepers Newsletter and the Wild Maine Blueberry Newsletter. It will be assumed that the subscriptions to these newsletters will reflect the number of stakeholders reached. In addition, attendance at blueberry grower and beekeeper meetings will be used to calculate numbers of stakeholders reached and the report to the legislature and Maine Board of Pesticide Control will add additional stakeholders to the outreach planned above.

V. WORK PLAN:

This proposed study involves selecting volunteer beekeepers who are willing to trap pollen on their own hives or moving University of Maine hives into areas for pollen trapping. Six landscapes have been selected for exposure assessment. These landscapes are: wild blueberry, apple, potato farms, suburban residential, urban, and natural “semi-pristine” landscapes. The reason that we are selecting these six landscapes is to determine if:

1. Agricultural areas are sources of significantly greater exposure than non-agricultural landscapes.
2. If residential lawns and home gardens are indeed the worst source of exposure of pesticides to bees
3. If major plant sources of exposure are similar across landscapes or differ from landscape to landscape

Identification of volunteer beekeepers in each landscape will be identified by Dr. Drummond in January of 2015 working in close cooperation with Ms. Erin MacGregor of the Maine State Beekeepers Association. In each landscape 5 apiaries or sites will be pollen trapped using the methods of Drummond et al. (2012). This work will be accomplished by the part-time technician hired from the proposed funding and it will commence in May 2015 and continue through August 2015 (4 months). At each site 4 pollen traps will be placed on the entrance of honeybee hives in the morning before honeybee foraging commences or in the evening after foraging has ended for the day. Pollen traps will be left on the hives for 2 days after which pollen will be

collected and the pollen contents of all four pollen traps will be decanted into a single 250 ml collecting vial. This vial will be labeled as to the date, landscape, and location. The trapping will be performed both in the spring and mid-summer at each location and the pollen from both time periods will be pooled so that each location (total n=30) will yield a single seasonal pollen sample. The pollen samples will be picked up from the volunteer or the University of Maine mobile hives and stored in a refrigerator at the University of Maine until late summer. In late summer the vials will be split into two subsamples and one subsample will be packaged and shipped **by Dr. Drummond in September 2015** to Dr. Brian Eitzer, an analytical chemist at the Connecticut Agricultural Experiment Station. Each of the 30 samples will be analyzed for 175 pesticides and their metabolites at a detection level of 1 ppb (1 part per billion). Pollen will be assessed for all common pesticides using a modified QuEChERS procedure (Drummond et al. 2012). After the chemical analysis **in the winter of 2015-2016**, a database will be sent to the University of Maine that will list the concentration of all detected pesticides in each of the 30 locations. The second subsample will be observed under the microscope so that the major pollen species in each sample can be identified **by Dr. Drummond during the winter 2016**.

Summary of the data **by Dr. Drummond** will be performed **in the winter of 2016** using Excel pivot tables and graphical analysis. Mean exposure concentration for each landscape will be calculated by logarithm transformation of the data prior to calculating the average. Statistical analysis will consist of Analysis of Variance to test our initial hypotheses that agricultural areas are sources of significantly greater exposure than non-agricultural landscapes and that residential lawns are also a significant source of exposure. In addition, we will determine if geographic region in Maine has any relation to honeybee exposure (ie. north vs . south). The last hypothesis that we will test is whether plant pollen species relative abundance varies by landscape. Multivariate ordination, such as Non-metric Multi-dimensional Scaling, will be used to assess overall differences in total toxicant signature in exposure between the landscapes. **All of the advanced statistical analysis will be conducted by Dr. Drummond in the spring of 2016 and a report will be written at this time summarizing the results.**

VI. BUDGET NARRATIVE (2014-2015):

We are requesting \$25,355 to conduct this study. The budget proposed will cover a temporary field technician for the spring and summer. This person will assist Dr. Drummond in sampling the landscapes for honeybee pollen. This project will require considerable travel throughout Maine and so a budget has been estimated for sampling pollen in the six landscapes. The cost of supplies are minimal, mainly the cost of pollen traps. The chemical analysis will be contracted out to the Connecticut Agricultural Experiment Station. Printing charges will cover both a scientific journal article and an “in-house” report for the people of Maine. The detailed budget narrative is as follows:

- 1. Salary Research Associate - \$14,000;** \$3500/month for 4 months (Univ. of Maine Hire)
- 2. Benefits for Research Associate (University of Maine) - \$1120** for 4 months @ 8.0%
- 3. In-State travel for pollen trapping - \$2,200** =5,000 miles at \$0.44/mile

4. Supplies – \$435

25 pollen traps @ \$15.00 each = \$375

100 elbow pins for securing traps @ \$1.00 / 10 pins = \$10.00

pollen storage vials @ \$0.50 for 100 vials = \$50.00

5. Contractual - \$6000; Analytical Chemistry, Connecticut Agricultural Experiment Station @ \$200 / sample for 30 samples

6. Other - \$1,600

Publications: Scientific Publication (\$500) and Agency Report (\$1000)

Shipping pollen to chemistry Lab @ \$100.00

TOTAL REQUESTED BUDGET = \$ 25,355

Table 2. Requested budget by category.

BUDGET (2014-2015)	
OBJECT CLASS CATEGORIES	
a. Personnel	\$14,000
b. Fringe Benefits	\$1,120
c. Travel (in-state)	\$2,200
d. Equipment	\$0
e. Supplies	\$435
f. Contractual	\$6,000
g. Construction	\$0
h. Other	\$1,600
i. Total Direct Charges (sum of 6a-6h)	\$25,355
j. TOTALS (6i)	\$25,355

The University of Maine Office of Research and Sponsored programs are able and committed to follow the procurement procedures which reflect applicable State and local laws and regulations

and conform to the Federal laws and standards identified in [7 CFR Part 3019.40 through 48 or 3016.36](#), as applicable.

VII. PROJECT COMMITMENT:

The Board of Pesticide Control (Mr. Henry Jennings) and the Maine State Apiary Inspector (Mr. Tony Jadczyk) have agreed to consult with the University of Maine (Dr. Frank Drummond and Dr. James Dill) to conduct this study. Volunteer beekeepers will also be utilized to assist in pollen trapping. Dr. Brian Eitzer at the Connecticut Agricultural Experiment Station has agreed to conduct the analytical chemistry on the pollen samples. **The specialty crop stakeholders that support this project, in addition to Maine beekeepers, are the Maine wild blueberry growers, Maine apple growers, and Maine organic vegetable growers. Dr. Drummond received confirmation of this commitment from these stakeholders in pollination workshops offered this spring (2014).**

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II. PROPOSAL TITLE AND ABSTRACT

TITLE: Increasing the Food Safety Margin of Wild Blueberries through Improved Intervention Measures

ABSTRACT: The Wild Blueberry Commission of Maine proposes using \$56,875 in Specialty Crop Block Grant (SCBG) funding for the project *“Increasing the Food Safety Margin of Wild Blueberries through Improved Intervention Measures”*. Dr. Vivian Wu, University of Maine Professor of Microbiology and Food Safety, will conduct research to develop effective intervention technologies using chemical washing (chlorine, chlorine dioxide (ClO₂), lactic acid, and ozone) to reduce microbial loading on frozen processed wild blueberries. This proposal is expected to develop outcomes that increase the margin of food safety for Maine wild blueberries that will protect the consumer and the economic wellbeing of Maine’s 510 growers and the \$250 million economic contribution of wild blueberries to the Maine economy. We propose to evaluate efficacy of sanitizers at short contact times in inactivating inoculated foodborne pathogens from the surface of wild blueberries. Blueberries will be inoculated with a pathogen cocktail. Individual chemical sanitizers and/or combinations will be applied with single spray or double spray equipment on the surface of berries. Treated blueberry samples will be frozen storage at -15°C for 1 week. Bacterial enumeration will be conducted. Expected results from enumeration should show a 5 log CFU (colony forming unit) pathogenic reduction when the optimal sanitation spraying system is established and spray sanitation measure is coupled with freezing. Successful outcomes of the project will provide wild blueberry processors with effective intervention methods to increase the food safety margin of the crop.

III. PROJECT PURPOSE

The Wild Blueberry Commission of Maine proposes using \$56,875 in Specialty Crop Block Grant (SCBG) funding for the project *“Increasing the Food Safety Margin of Wild Blueberries through Improved Intervention Measures”*. This project will address two of the USDA objectives, “enhancing food safety” and “developing Good Manufacturing Practices” for small farmers, packers, and processors and the Commissioner of the Maine Department of Agriculture, Conservation and Forestry specific priority area of - “Enhancing food safety research and education, primarily in relation to new FDA rules regarding improved handling and processing of specialty crops.”

Food safety is of great concern to consumers, farmers, and food processors. Over 500 Maine farms deliver fresh wild blueberries to Maine’s 5 processors. Recently, nationally publicized food safety outbreaks in produce have generated public alarm, and it is imperative for the long term health of Maine’s wild blueberry business and its customers that the margin of food safety for Maine wild blueberries be optimized. This project is very timely because customers who choose and consume wild blueberries are seeking the most healthy and safest products for purchase now. The Maine wild blueberry industry is focused on using Good Manufacturing Practices including using the highest processing standards and most effective food safety controls and intervention measures. Increasing the margin of food safety for Maine wild blueberries will protect the consumer and the economic wellbeing of Maine’s 510 growers and the \$250 million economic contribution of wild blueberries to the Maine economy.

The 2013 Food and Drug Administration recall, and Center for Disease Control case of foodborne illness related to consumption of Townsend Farms Frozen Berries is a frightening example of the potential risk to human health from consumption of tainted frozen mixed berries. Because the case occurred recently, the dollar economic cost has not been quantified, but the human toll of 162 cases of hepatitis A traced back to this company was at the least intolerable. Eventually the Oregon farm's use of pomegranate seeds imported from Turkey for use in their mixed fruit blend was identified as the culprit carrying the hepatitis A (available online at <http://outbreakdatabase.com/details/hepatitis-a-linked-to-townsend-farms-frozen-berries-march-july-2013/?outbreak=berries&vehicle=berries>). Ultimately 10 states reported human illness (162) and hospitalization (71) as a result of this outbreak. Though only three states located east of the Mississippi reported illness, New Hampshire and New Jersey are nearby and the Townsend Farms product, not the lot number in question, was available in a Bangor, Maine area club store. When this outbreak was made public, local Maine companies were contacted by consumers about the product safety of their frozen wild blueberries sold at retail outlets here in Maine (per. comm with wild blueberry processor).

The complete removal of foodborne pathogens from the surface of any produce including blueberries, without adversely affecting the quality of it, is considered a challenge and is very important for the wild blueberry industry to address. Therefore, this important project will develop and evaluate an efficient sanitization strategy that not only contributes to effective inactivation of foodborne pathogens but also maintains the high quality of wild blueberries. The microorganisms on the surface of the berries are appreciably reduced by application of chemical sanitizers and freezing. 2014 survey information gathered from the wild blueberry processors for this proposal indicates that commonly used chlorination with short treatment times under 4 or 5 minutes may not effectively reduce microorganisms and improved controls are needed. Therefore, we propose to study multiple sanitizer "hurdles" (approaches to control or eliminate foodborne pathogens that the pathogen has to overcome if it is to remain active in the food) applied together with standard industry use of individually quick freezing process to enhance the efficiency of sanitation and eliminate microbial growth from the surface of wild blueberries.

Objectives

Wild blueberries are one of the major agricultural products of Maine and make a \$250 million annual contribution to the state economy. Prevention of microbial contamination in order to produce safe products is essential for the wild blueberry industry. Current use of sanitizer at rates of 50 to 200ppm of chlorine (Cl₂) in spray water by the blueberry industry may not effectively reduce the microbial load. There is potential for occurrence of substantial growth of microbial survivors during berry cleaning and freezing. Furthermore, some chemical by-products formed when chlorine is used for reducing microorganisms in food processing can be considered as mutagenic or carcinogenic. Therefore, an effort has to be made to design an efficient sanitization protocol at suitable concentrations which promises to be effective at killing bacteria and also not adversely affect the quality of produce.

This project has two primary objectives:

Objective 1. To evaluate the effectiveness of different chemical sanitizers using short contact times in combination with freezing on microbial reduction

Objective 2. To develop an effective double spraying system for microbial reduction by combining two chemical sanitizers along with freezing

Project Context

Current sanitation practice in wild blueberry processing has achieved a one log reduction and is baseline benchmark for this study (Wu pers. Comm.) We will target achieving at least five log CFU/g reduction of foodborne pathogens including *Salmonella* and *Listeria monocytogenes* from the surface of inoculated blueberries. Product quality will also be evaluated after the freezing treatment. Results of this study will provide efficient microbial reduction protocol for post-harvest treatment of wild blueberries and help the Maine wild blueberry industry to provide the safest products possible.

Freezing generally retards the growth of microorganisms thereby preserving the quality of fruit. Dr. Wu's previous research studies showed that, a combination of barriers like chemical sanitizers and freezing together can eliminate the pathogens more effectively from the surface of wild blueberries. This project will expand the use of this combination protocol to develop a multi-barrier approach protocol with short contact times that are more commonly utilized in processing lines currently in operation, and determine if this can effectively eliminate the foodborne pathogens of at least a 5 log CFU/g reduction, from the surface of wild blueberries. Wild blueberry processors responding to a survey questionnaire earlier in 2014 indicated that this research and the results will add a more practical approach tool to their food safety processing protocol.

This project is very important and timely because Maine wild blueberry processors must produce a safe and healthy product for consumers and their other customers. The industry processors realize that both fresh and frozen wild blueberries can be susceptible to microbial contamination during growth, harvest, transport, and processing. In the past the Center for Disease Control and Prevention has documented several outbreaks of foodborne infections associated with fruit salad, mixed fruits, strawberries, and blueberries. In 1984, fresh blueberries were linked to a possible outbreak of listeriosis in Connecticut, with an undetermined quantity of frozen cultivated blueberries confirmed 14 years later from California, Illinois, and Australia, without incident due to contamination with *L. monocytogenes*. In response to these events and a more recent outbreak of hepatitis A in New Zealand in which blueberries were likely contaminated from infected food handlers or fecally contaminated groundwater, buyers of frozen blueberries are now beginning to test for foodborne pathogens including *L. monocytogenes* and *Salmonella*.

This project has not be submitted to or funded by another Federal or State grant program. This proposal strengthens efforts made by the Wild Blueberry Commission and the University of Maine to develop best practice in food safety in processing for the wild blueberry crop.

IV. POTENTIAL IMPACT

The importance of maintaining and continually improving the margin of food safety in processing Maine's wild blueberry crop is a priority for growers and processors. Because over 99% of wild blueberry crop is frozen and the anatomy of wild blueberries lends itself to ease of sanitation, the industry is well equipped to maintain food safety in processing. However, Dr. Vivian Wu, an expert in food safety, has made it clear to the wild blueberry industry that presence of a single cell of some bacteria that are harmful to humans can risk an outbreak of food borne illness and failure of the whole industry. While the Center for Disease Control and Prevention can often track the source of a foodborne illness outbreak to one field or facility, the damage to the industry, its reputation as a healthy fruit, and its contribution to the Maine economy could easily be jeopardized.

Wild blueberry processors will need to increasingly use a combination of various microbial reduction methods, also called "hurdle technology" in their processing facilities. This food safety technology increases the number of fail-safe hurdles based on strict industry and government standards. Consumers, and the wild blueberry industry customers who sell products to them, expect no less from Maine's wild blueberry growers and processors. The margin of food safety is evaluated at a microbiological level and risk reduction methods must be tested and optimized. *S. Typhimurium* one of the two pathogens that will be tested in this proposed research project, is one of the most common bacteria that cause illness in the U.S. The antimicrobial effects of the washes and freezing will also be tested for reducing the presence of *L. monocytogenes*, which is known to survive in freezing temperatures in use by frozen food and the wild blueberry processing industry. Lab research must resemble in-plant processing as closely as possible and/or translate into cost effective methods of reducing food safety risk.

Studies have shown that the farm level losses from outbreaks such as the 2006 *E. coli* illness caused by fresh spinach were \$8 million. (*Potential Impacts of Foodborne Illness Incidences on Market Movements and Prices of Fresh Produce in the U.S.*, Palma, Ribera, Bessler, Paggi, and Knutson, *Journal of Agricultural and Applied Economics*, 42,4(November 2010):731–741). This outbreak was never pin pointed to one farm and estimates show that recall and sales losses cost the U.S. spinach industry \$350 million dollars and years to regain consumer confidence. (*10 Costly food recalls* by Jane McGrath, available online at <http://money.howstuffworks.com/10-food-recalls.htm>). In 2006, 46,000 acres of spinach were harvested in the U.S. with production of 6.2 million cwt. of fresh spinach valued at \$182 million dollars. This means that twice the total annual production value was lost by the spinach industry in recall and sales in 2006. An \$8 million farm level production loss equaling 4% of the total production value shattered the industry and took years to recover. It is important to note that these simple calculations do not include the wider economic impact an agricultural crop has in a state or the human cost of illness incurred by an outbreak.

For purpose of understanding the potential economic impact to Maine's 510 wild blueberry growers (2012 USDA Ag Census) and processors of the risk of crop loss and production value, it is important to understand that an outbreak of foodborne illness can stem from any one of wild blueberry farms in the State or at a processing facility where most, if not all growers sell their fruit. We can estimate dollar amounts based on USDA-NASS statistics showing that the 3 year

average production of wild blueberries is 84.7 million pounds (Based on 20010-12 - 3 yr. avg. crop, USDA NASS) at a grower price of \$0.76 (2010-12- 3yr. avg., USDA NASS) calculated to total \$64.3 million with a direct sales impact of \$173 million (Planning Decisions, Inc. 2009). What we cannot place value on, is the reputation that is lost as a result of a food borne illness in agriculture and food processing.

In the case of the 2006 fresh spinach food safety incident the cost to the \$182 million industry was over \$350 million. It is not inconceivable that a wild blueberry food safety incident could cost the Maine industry with \$173 million in annual direct sales up to \$330 million. Even if the economic damage to the industry was only half of the food safety recall in the spinach industry, proportionally that equals \$165 million. The losses would be felt at the grower level and could put in jeopardy the economic viability of Maine's wild blueberry processors. Losses of wild blueberry production and value such as these are unacceptable.

With a total economic impact of \$250 million on the Maine economy, the burden of a wild blueberry industry wide loss would primarily be incurred by the Washington and Hancock County region of Maine where over 80% of all wild blueberry acreage and commercial production is located. The Passamaquoddy tribe owns and operates one of the largest farms in Washington County.

V. EXPECTED MEASURABLE OUTCOMES

To help the wild blueberry industry utilize effective intervention methods to maintain and improve the food safety margin for wild blueberries, we will first comprehensively evaluate the decontamination of chemical washing (chlorine, chlorine dioxide, lactic acid, and ozone) on microorganisms associated with wild blueberries (Objective 1 of the project) using short treatment times by comparing the inoculated berries to those that have not been sanitized. **Project results will be distributed in the annual Wild Blueberry Research and Extension program report to the 7 member Advisory Committee and to 6 Quality Control and Food Safety specialists at wild blueberry processing facilities in the state of Maine. Responses and comments from the members and specialists who receive project reports will be requested.**

The effective methods (single or in combination) will be applied in a double spraying system that is similar to the single chlorine spraying system used in the common IQF processing facility (Objective 2 of the project). The optimal method (optimal treatment) will be compared with single treatment and the control which, in this case, is the inoculated wild blueberry samples that have not been sanitized, for testing the effectiveness of microbial decontamination. A 5 log reduction (a comparison between the control and optimal treatment) is expected to be achieved. This meets the limits for mesophilic aerobic bacteria and pathogens requested by buyers of frozen blueberries nowadays. We will utilize a double spraying system that is located at USDA ARS in Beltsville, MD to establish the optimal condition for decontamination under a situation that is similar to the IQF processing facility.

Project Outcomes

1. The chemical sanitizers when used for shorter contact times and combined with freezing, are expected to effectively reduce the level of foodborne pathogens from the surface of blueberries without adversely affecting berry quality.
2. The use of multiple barriers like combination of chemicals and freezing storage together, are expected to eliminate *L. monocytogenes* and *Salmonella* at significant reductions of at least 5 log CFU.
3. This approach will develop more efficient and practical sanitization protocol with short contact times that can be used in wild blueberry processing to provide microbial safe product to consumers.

Outcomes 1 and 2 are expected to be achieved within the yearlong scope of this project. Data and results from these experiments will also be monitored and evaluated within the yearlong project. Further analysis and results including completion of the outcome 3 above, are expected after the project end date.

Over 500 Maine farms deliver fresh wild blueberries to Maine's 5 processors. Results will be disseminated to the Wild Blueberry Advisory Committee who represent wild blueberry processors and growers in the state of Maine. The Advisory Committee advises the University of Maine (including the Maine Agricultural and Forest Experiment Station and Cooperative Extension) about wild blueberry grower priorities as related to crop production, and food safety research and Extension. Dr. Wu will work directly with University of Maine Wild Blueberry Extension specialist to disseminate results to growers and processors during Extension educational sessions, Wild Blueberry Advisory Committee meetings (twice / year) and, if appropriate, through Fact Sheets developed to address food safety and handling issues in the field and at processing facilities. The outcomes of this project are expected to benefit the vast majority of Maine's 510 wild blueberry growers and all value added processors producing or using IQF wild blueberries.

The Goal of Objective 1 is to increase the level of bacterial reduction with chemical sanitizers which can be used at lower and safer concentrations and also for more practical time-periods. Dr. Vivian Wu expects this to be achieved when these treatment are combined with freezing treatment. Since 99% of Maine wild blueberries are individually Quick Frozen (IQF), this may be a more convenient and practical approach for processors to use in order to further reduce food safety risk. This objective will also rate the visual quality of the blueberries using the 9-point Hedonic scale after exposure to different treatment conditions.

The Goal of Objective 2 is to use the results obtained from Objective 1 (log reduction data) to develop a double spray system that could provide a more efficient and practical post-harvest food safety control strategy for wild blueberry processing. We will apply combination of chemical treatment at low concentration for short time-periods along with freezing treatment to achieve a 5 log CFU reduction of foodborne pathogens, especially when the lower concentration of single sanitizer and short treatment time cannot sufficiently eliminate microbial loads. As most of these sanitizers are in-expensive, this improved method can also be cost-effective for wild blueberry processors. The data will provide results that can be used to increase the food safety margin and

improve the existing processing protocols for frozen berries in order to prevent pathogen contaminations.

VI. WORK PLAN

Experiments to test the efficacy of chemicals combined with freezing on wild blueberries will be setup in late October 2014. All chemical sanitizer solutions will be prepared in sterile deionized water and the concentrations will be measured using titration method before applying them to blueberries. All the required media for the bacteria will be ordered and prepared at the beginning of these experiments.

For Objective 1, we will examine the effect of Cl₂, ClO₂, lactic acid, and ozone in removing *L. monocytogenes* and *Salmonella* from the surface of blueberries. At the end of October till mid of January, each chemical treatment against each pathogen will be evaluated in three replicates. In January and February 2015, the residual and visual quality testing of each chemical treatment will be conducted and also data analysis will be performed for all the chemical treatments. A bacterial cocktail (2 strains of *L. monocytogenes* and *Salmonella* each) will be prepared using an overnight culture and frozen blueberry samples (25g) will be artificially inoculated with 9 log CFU of bacterial cocktail by a dipping method. The inoculated berries will be dried for 2h in a laminar flow hood. Fresh solutions of chemicals in distilled water will be prepared and 250ml of these chemicals (single and in combination) will be sprayed on blueberries. They will be exposed for different contact times (30sec, and 1 and 3min). After the end of each treatment time, they will be stored in freezer at -15°C for 1 week and bacterial enumeration (both pathogen and total microbial load) will be done. For objective 1, chemical sanitizers including chlorine (at 200ppm), aqueous chlorine dioxide (at 15ppm and 20ppm) and lactic acid (2%) will be used for short contact times (30sec, 1min and 3min). Two hundred and fifty ml of this mixture will be sprayed on inoculated blueberries for contact times such as 30sec, 1min and 3min. These treated blueberries will be stored at 15°C. The aggregated effect of chemicals with freezing storage will be evaluated by determining the viable cell count of bacteria. Visual quality of the blueberries will be recorded after 1 week storage for every treatment.

For Objective 2, chemical combination with appropriate concentrations will be designed by conducting several preliminary experiments. Inoculated blueberries will be exposed to different chemical combinations along with freezing. A double spray system using a combination of two sanitizers including chlorine and lactic acid, chlorine dioxide and lactic acid, chlorine and chlorine dioxide, chlorine and ozone, chlorine dioxide and ozone, ozone and lactic acid will be sprayed for 30sec, 1min and 3min contact times. Again, sanitation will occur in combination with freezing storage at 15°C for 1 week and results are expected to show significant log reductions thus lowering the potential risk of any foodborne outbreaks in wild blueberries. All the combination of chemicals will be tested against *L. monocytogenes*, and *Salmonella*. This will be done by the end of May. In summer 2015 we will spend 3 month in USDA-ARS Beltsville, Maryland to use their double spraying system to validate the combination of treatments. In September 2015, residual and visual quality testing of blueberries after treatment with combination chemicals will be performed and data analysis will be done. The annual report will be generated at end of September 2015 upon request from ME Dept. of Agriculture, Conservation, and Forestry according to USDA guidelines. **Project reports for Wild Blueberry**

Research and Extension program that are distributed to the Wild Blueberry Advisory Committee, are completed annually by January the following year of the crop production season. Due to Specialty Crop Block Grant proposal reporting timeline, preliminary project results will be included in the annual report required by USDA in October/November 2015 at completion of the project. Additional research conclusions will be finalized for the Wild Blueberry Research and Extension project reports submitted to the Wild Blueberry Advisory Committee in January 2016.

Activity	Time Period	Personnel
Project Initiation	October 2014	P. Kontur, Wild Blueberry Commission Dr. Wu and research associate
Obtain and analyze different chemical treatments in combination with freezing at different contact times against <i>L. monocytogenes</i>	November, Mid-December 2014	Research associate
Obtain and analyze different chemical treatments in combination with freezing at different contact times against <i>Salmonella</i>	Mid-December 2014 to January 2015	Research associate
Data analysis and statistical analysis	February 2015	Dr. Wu and research associate
Preliminary analysis of combination of chemicals	March 2015	Dr. Wu and research associate
Final analysis of combination of chemical treatments along with freezing against <i>L. monocytogenes</i>	March to Mid-April 2015	Research associate
Final analysis of combination of chemical treatments along with freezing against <i>Salmonella</i>	Mid- April to May 2015	Research associate
Validating the combination of treatments using double	June-August 2015	Dr. Wu and research associate

spraying system in Maryland USDA		
Visual quality and residual testing of blueberries exposed to combination of chemical treatments	September 2015	Research associate
Distribution of preliminary research results to Advisory Committee	October 2015	P. Kontur, Wild Blueberry Commission Dr. Wu
Annual Report	October 2015	P. Kontur, Wild Blueberry Commission Dr. Wu

Patricia Kontur, Director of Programs for the Wild Blueberry will monitor progress of Dr. Wu's lab for both objectives 1 and 2. Dr. Wu's lab is responsible for the collection of data and analysis. Dr. Wu will develop the research reports which will be presented to the Commission's research and Extension committee (the Wild Blueberry Advisory Committee). Patricia Kontur will distribute the research results to all IQF wild blueberry processors in Maine.

VII. BUDGET/BUDGET NARRATIVE

BUDGET	
OBJECT CLASS CATEGORIES	
a. Personnel	\$31,200
b. Fringe Benefits	\$ 2,402
c. Travel	\$ 5,300
d. Equipment	\$ 8,488
e. Supplies	\$ 8,905
f. Contractual	
g. Construction	

h. Other	\$500
i. TOTAL Direct Charges	\$56,875.00
j. Indirect Charges	
k. TOTALS (sum of 6i and 6j)	\$56,875.00
PROGRAM INCOME	

Budget Narrative

A. Salaries - \$31,200: Funds are requested for salary for two project research associates (6 month/research associate) one for objective 1 and one for objective 2 at \$2,600 per month for a total of \$31,200. One will be focusing on the lab scale optimal studies and the other one will be in charge of spraying system and scale up.

Name/Title	Level of Effort (# of hours OR % FTE)	Funds Requested
Shravani Tadepalli, Temporary project research associate	40hr/week for 6 months	\$15,600
Research associate will be hired prior to the last six months of the research project Temporary project research associate 2	40hr/week for 6 months	\$15,600

Personnel Subtotal	\$31,200
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B. Benefits - \$2,402: Fringe benefits are calculated for the project research assistant at 7.7%.

Name/Title	Fringe Benefit Rate	Funds Requested
Shravani Tadepalli, Temporary project research	7.7%	\$1,201

associates		
Research associate will be hired prior to the last six months of the project; Temporary project research associate	7.7%	\$1,201

Fringe Subtotal	\$2,402
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C. Travel \$5,300: Funds are requested for out-state for travel to USDA ARS Beltsville Maryland to using the double sprayer system and conduct the experiments in summer (3 months). Estimated costs \$800 for airfare and cost of living for 3 month - \$4,500 (\$1500/month for \$1,000 for rent and \$500 for meals). Research associate traveling to Beltsville, Maryland will be required to follow the procedures including required supervisor/Faculty approvals according to the **University of Maine System Administrative Practice Letter Section IV-B Subject: Travel and Expense Procedures**. All expenses will be submitted through the University of Maine. Any projects that are federally funded will be controlled by federal guidelines and requirements if appropriate.

Trip Destination	Purpose of the Trip	Type of Expense (airfare, car rental, hotel, meals, mileage, etc.)	Unit of Measure (days, nights, miles)	Number of Units	Cost per Unit	Number of Travelers Claiming the Expense	Funds Requested
Beltsville, MD	Conducting experiment using the double sprayer system	Airfare, cost of living	month	3	\$800 for airfare Cost of living including meals \$500 and	1	\$ 5,300

					rent \$1,000: Total \$1500/mon		
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Travel	\$5,300
Subtotal	

D. Equipment \$8,488: Funds are requested for a bench-top Ozone Generator (\$5488) and an ozone monitor (\$3000) for conducting the experiments.

Item Description	Justification for Equipment	Rental or Purchase	Funds Requested
Ozone Generator	For generating ozone	purchase	\$5,488
Ozone monitor	For measuring ozone concentrations	purchase	\$3,000

Equipment Subtotal	\$8,488
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E. Supplies \$8,905: Funds are requested for materials associated with the project and consumable supplies including chemicals; reagents, kits, laboratory culture media; disposable labware (petri dishes, bacterial growth media, pipette tips, pipettes, stomacher bags, centrifuge tubes), scale up materials for the double sprayer system, etc.

Item Description	Justification for Supplies	Per-Unit Cost	Number of Units/Pieces Purchased	Funds Requested
Petri dishes	bacterial enumeration	\$90/box	8	\$720
Stomacher bags	sample preparation /stomaching	\$88/box	4	\$352
1 ml pipets	sample dilution	\$347/box	4	\$1388
5 ml pipets	sample dilution	\$291/box	4	\$1164
10 ml pipets	sample dilution	\$283/box	4	\$1132
Latex gloves	aspect technology	\$84/pack	6	\$504
bacterial media (XLD)	culturing bacteria	\$70/bottle	5	\$350
bacterial media (MOX)	culturing bacteria	\$85/bottle	5	\$425

bacterial media (BHI)	culturing bacteria	\$80/bottle	5	\$400
MOX supplement	culturing bacteria	\$150/vial	5	\$750
pipette tips	dilution, sampling	\$200/bag	3	\$600
scale up parts/materials	for building double spraying system	\$500	various	\$500
Chemicals	ClO2, lactic acid, chlorine	\$500		\$500
Centrifuge tubes	centrifugation of samples	\$200/box	1	\$200

<i>Supplies Subtotal</i>	\$8,985
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H. Other \$500: Funds are requested for printing educational materials to share with growers and processors as well as costs of publishing manuscripts in scientific journals such as cost for reprints and necessary illuminations.

Item Description	Justification of the Expense	Per-Unit Cost	Number of Units	Funds Requested
Educational materials	To share the finding of the project with the Wild Blueberry Advisory Committee growers and processors			\$50
Publication cost	For reprints, necessary illumination costs			\$450

<i>Other Subtotal</i>	\$500
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VIII. PROJECT COMMITMENT

The Wild Blueberry Commission and the Wild Blueberry Advisory Committee (supported by Commission staff) and the University of Maine will oversee all activities related to this project. Dr. Vivian Wu is a Professor of Microbiology and Food Safety, School of Food and Agriculture and will serve as the Project Director (PD) and take responsibility for project. Dr. Wu will be the lead researcher at the University and will provide regular updates on the program to the Wild

Blueberry Advisory Committee and a final report will be completed and presented to the Committee during their fall 2015 meeting. The Advisory Committee will work closely with the University of Maine and Dr. Wu to ensure all aspects of the program are being conducted to meet the needs of the Maine wild blueberry industry. She has over 15 year research experience in control and prevent microbial contaminations. She has over 17 year experience in doing research in food safety and over 12 year experience in doing research specifically in produce safety. Dr. Wu has been working with the Wild Blueberry Commission and the Advisory Committee on the blueberry safety research for more than 10 years. She has numerous publications in developing innovate technologies for enhancing the safety of blueberries and studying blueberry health benefits.

The Wild Blueberry Commission of Maine (WBC) has agreed to work with the University of Maine to provide all the staffing and materials for the successful completion of this research and education effort. The Wild Blueberry Advisory Committee is a standing committee of the WBC made up of seven growers and or processors who serve four year terms. The Committee was established by the Legislature 60 years ago to advise the University (research and Cooperative Extension staff) on industry research and development priorities. The Committee is active to this day. The Wild Blueberry Commission and the Wild Blueberry Advisory Committee are committed to the implementation of the project.

II. PROJECT TITLE AND ABSTRACT

TITLE: Improving Integrated Pest Management Practices for Maine Wild Blueberry Growers

ABSTRACT: The Wild Blueberry Commission (WBC) proposes to develop and implement an Integrated Pest Management (IPM) program for weeds, diseases and insects for Maine's 510 wild blueberry growers. This project will address acute, emerging, and important crop management needs that threaten Maine wild blueberry production by developing IPM program activities. If IPM practices and enhancements are not developed to address these challenges Maine's 84.7 million pound wild blueberry crop, \$64.7 million farm gate revenue and \$250 million in annual Maine economic impact are at significant risk. This IPM program will conservatively prevent \$32 million in annual grower revenue losses. This integrated proposal contains three focus areas. First: Evaluate herbicides with different modes of action to effectively control resistant weeds; Develop effective weed resistance strategies and educate growers on weed resistance management. Second: Use weather station network data and applied research to provide growers with disease forecasts to reduce crop loss and fungicide use; develop new IPM disease and insect management enhancements including: conduct a fungicide evaluation studies to provide data on mummy berry, Botrytis blossom blight, and leaf spot diseases to reduce fungicide resistance; and predictions on emergence of Spotted Wing Drosophila and Blueberry Fruit Fly. Third: Develop an IPM program for blueberry tip midge and determine the impact of wild blueberry damage from sap feeding insects resulting from current fertility and disease management practice.

III. PROJECT PURPOSE

The Wild Blueberry Commission of Maine (WBC) is requesting \$116,268 in Specialty Crop Block Grant funding for the project, *Improving Integrated Pest Management Practices (IPM) for Maine Wild Blueberry Growers*. The project will focus on the USDA objective, pest and disease control, and the Maine Department of Agriculture, Conservation, and Forestry Commissioner's special priority area, enhancing integrated pest management research and education for specialty crops that will result in enhancing the competitiveness of specialty crop growers. The IPM weed resistance project also falls under the special priority area of multi-year proposals from prior year (2012-13) that was partially funded.

This project will address acute, emerging, and important IPM needs for weeds, diseases, and insects that threaten Maine wild blueberry production and yield by executing the following IPM research and education activities; ***1. IPM Strategies for Weeds resistance, 2. Enhancing Wild Blueberry IPM Disease Forecasting and Management, and 3. Insect IPM for Blueberry tip midge and Common Sap Feeding Insect pests.***

Over the past 30 years, wild blueberry yields have increased from an average of 20 to 87 million pounds a year, largely because good weed control and effective disease and insect pest management have permitted more use of fertility, pollination and irrigation techniques. Currently Maine's 510 wild blueberry growers (USDA 2012 Ag Census) are contending with weeds resistant to control, springs with long wet periods ideal for fungal diseases, and new insect pests such as tip midge. If IPM practices and strategies are not developed to address these challenges 50-80% of the Maine's wild blueberry crop and its economic contribution of \$250

million annually is at significant risk. This proposal is timely as it addresses new and emerging pest management challenges by developing and supporting IPM techniques for growers.

IPM strategies for Weeds resistance

Wild blueberry growers have reported to Dr. David Yarborough, UMaine Wild Blueberry Extension Specialist, that weeds in their fields are not responding to current control practices resulting in poor weed control and crop losses. The use and heavy reliance on the principal herbicide hexazinone to control weeds is less effective and there has been a shift in weed types. Herbicide resistance has not been an issue until recently. In addition, because custom harvesters move between Canada and Maine, there is also a high potential for introduction of weed seeds that are resistant to current control into Maine wild blueberry fields (Boyd and White, 2009). Dr. Yarborough and other researchers have documented this weed control resistance in Canada (Jensen and Yarborough, 2004). If the weeds are not effectively controlled then other inputs will not maintain the increase in production growers have achieved in recent years (Yarborough, 2004). Prevention of weed resistance is an essential part of IPM and to maintaining and improving wild blueberries productivity.

Implementing an effective IPM weed control program that addresses resistance requires using multiple control options in different herbicide groupings. Herbicides with similar modes of action are identified by a group number. Rotating between groups with different modes of action will prevent weed resistance from developing. For growers to effectively implement weed IPM they need control options from different herbicide groups, weed identification and mapping techniques, and an understanding of resistance management. This IPM project proposes to evaluate herbicides with different modes of action and educate growers on effective weed resistance management.

Enhancing Wild Blueberry Disease IPM Forecasting and Management

This project will improve wild blueberry IPM mummy berry disease forecasting, and leverage past funding for the weather station network by: 1. Forecasting *Botrytis cinerea* fungus, 2. Developing a model to predict mummy berry spore producing apothecia development, 3. Investigating the potential to use virtual weather data in place of on the ground weather stations, 4. Researching options to address potential leaf spot management resistance, and 5. Further leverage the weather network data to support models for Spotted Wing Drosophila (SWD) and Blueberry fruit fly maggot emergence. A unique aspect of this proposal is the use of the weather station network to provide disease forecasting for growers while simultaneously using the data for research of new IPM disease management enhancements in commercial wild blueberry fields.

IPM projects funds for wild blueberry disease management were awarded in a one year 2013 Maine Specialty Crop grant. The grant provided Dr. Seanna Annis, Professor of Mycology at the University of Maine, funds to add capability and improve a network of 14 weather stations across wild blueberry growing areas in Maine. Dr. Annis makes IPM mummy berry disease management recommendations to growers across wild blueberry growing areas with valuable data provided by the network. Positive wild blueberry grower feedback has been widespread and increased use of the mummy berry forecast model is expected.

This project will maintain and improve the network for mummy berry disease forecasting, the number one economically damaging disease affecting wild blueberries. Without effective control, this disease can decrease growers' wild blueberry yields up to 80% by killing flower and leaf buds and infecting developing fruit. Effective forecasting increases control while minimizing fungicide applications. While less widespread, Botrytis blossom blight pressure varies from year to year often catching growers by surprise and inflicting significant localized crop damage. Effective Botrytis forecasting and scouting trials in 2013 will be further refined in 2014 and operationalized in 2015.

Mummy berry disease forecasting can be improved if, using weather station data, we successfully predict the timing of production and duration of survival of the fungal structures (apothecia) that produce infective spores. Dr. Annis will utilize cameras on 2 weather stations, a field plot experiment and a lab experiment, to monitor development of apothecia and, by correlating weather station data, develop a model of mummy berry apothecia development.

Currently growers are controlling leaf spot diseases in the prune year by utilizing mainly one fungicide, chlorothalonil, for control. To manage and prevent potential fungicide resistance other control options will be investigated.

The weather station network is proving to be a very effective IPM disease forecasting tool for the major wild blueberry diseases and a research tool to enhance IPM practices. However, the network equipment is expensive to set up and operate annually. Before the useful lifespan of the equipment declines, Skybit virtual weather data will be compared with on-the-ground weather station data for accuracy and applicability for use in the forecasting models. A positive result can lead to a less costly effective system that does not need to be redeployed annually.

In addition weather station data will be used to populate models that predict the emergence of adult spotted wing drosophila (SWD) and the blueberry maggot fly (BMF) insects. Both insects can have a devastating effect on yield, with SWD potentially causing 50% loss with heavy infestation. Giving growers an early warning when emergence of SWD and BMF is near will improve their timing for scouting early infestations and improve their control of these insects.

Insect IPM – Blueberry tip midge

Over the last two seasons growers have been challenged with the new invasive pest, Spotted Winged Drosophila. Recently another pest, the blueberry tip midge *Dasineura oxycoccana* has caused significant crop loss in wild blueberries. This pest is not new to the region, but it appears to have shifted from cranberry onto wild blueberry recently and in some areas of Maine, the pest can be found in moderate to high densities. Dr. Frank Drummond, Entomologist at the University of Maine has shown that blueberry tip midge can cause on average 50% flower bud reduction in 3 out of 4 years due to heavy larval feeding early in the prune year. This phenology suggests that management should be targeted soon after sprout emergence occurs in the prune year. Dr. Drummond will conduct research to determine if a spring focused tip midge IPM program can minimize wild blueberry crop and economic loss.

Insect IPM – Common Sap Feeding insect pests

Observations by researchers in some New Brunswick wild blueberry fields have shown that current prune year fertility and disease management practices may result in plants having an increase in soft, succulent tissue attractive to sap feeding insects that are common in Maine wild blueberries (Lynch, 2014). Excessive feeding by the insects could result in reduced plant health and crop yield. Dr. Drummond will investigate if current fertility and disease management practices are hosting sap feeding insects that are damaging the crop and reducing yield in Maine wild blueberries fields.

This proposal is very timely because increasing grower IPM knowledge base is essential to developing an integrated system of wild blueberry IPM practices. The Wild Blueberry researchers at the University are prepared to conduct the applied research and education that is necessary for an effective IPM program for all of Maine's wild blueberry growers. This proposal has NOT been submitted for funding to any other agency or USDA grants program. This proposal strengthens other efforts by the WBC and the University of Maine to develop least-toxic IPM strategies to control all important weeds, diseases and insect pests, so that Maine growers can produce a safe, healthy and abundant wild blueberry specialty crop.

IV. POTENTIAL IMPACT

All of Maine's 510 wild blueberry growers will receive tremendous benefit from addressing acute, emerging, and important IPM needs for weeds, diseases, and insects. This IPM research and Extension proposal takes an integrated crop system approach to address crop production problems providing economic benefits to growers and the Maine economy. The Passamaquoddy Tribe, one of the largest growers, and the communities in Downeast Maine will also benefit.

Increases in production over the last 30 years are due to use of University of Maine developed Integrated Pest Management (IPM) techniques that have shown good success but are now changing due to increased resistance of controls, ideal wet periods for fungal disease development in the spring, and dynamic changes in insect populations. IPM practices need to continually evolve and change to add more knowledge and tactics to control threats to the crop.

Resistance to weed control and improving management practices of disease and insect pests are three of the most serious IPM issues that affect all of Maine's 510 wild blueberry growers. Dr. Yarborough's weeds research has shown that yield losses can range from 36% to 80% without adequate control, and often growers will not find it cost effective to harvest a field with 80% grass cover, which results in a 100% crop loss. Dr. Yarborough reports that a five year average annual yield loss of 50% due to grass resistant to control is a conservative measure.

Dr. Annis's disease work has shown that mummy berry blight is the most serious wild blueberry disease, though Botrytis blossom blight and leaf diseases are also a threat to the crop and must be managed. Mummy berry blight can cause yield losses ranging from 25% - 80% without adequate control. A 50% loss estimate equals 42.3 million lbs. or a loss of over \$32 million/yr. in annual farm gate revenue to wild blueberry growers (3 yr. avg. crop 84.7 mil#, \$0.76/# (USDA NASS, 2013). Botrytis blossom blight can result in 10% yield loss. Using the above calculations, this could result in an additional 8.47 million pound loss or \$6.4 million in farm gate revenue for growers, a total of \$38.4 million in farm revenue due to disease.

Dr. Drummond’s work with blueberry tip midge has been shown to cause 50% flower bud reduction with associated reduction in yield, another \$32 million potential farm gate loss. If these risks are not managed wild blueberry crop failure could result for many growers.

Looking at potential impact from a grower’s perspective we know that using proper IPM in their field is the difference between making profit or encountering financial loss across the 2 year cropping cycle. For example, using a 20 acre average field size and, assuming the crop area is 10 acres (wild blueberry 2 year cropping cycle), an avg. 3,000 lb./per acre yield at \$0.76/lb. equals a two year gross revenue of \$22,800. For a small grower a 50% loss of yield and revenue will result in major crop and net financial loss. The threat of production loss from weed, pest and disease is disastrous for small growers. See enterprise budget calculation tool online at: <http://umaine.edu/blueberries/factsheets/marketing-and-business-management/blueberry-enterprise-budget/>

The annual direct sales impact of the wild blueberry business about, \$173 million with a Maine economic impact of \$250 million (2009, Planning Decisions). Effective IPM of weeds, disease and invading pests, protects a \$250 million contribution to Maine’s economy which is particularly important to the Downeast region and the Passamaquoddy tribe.

V. EXPECTED MEASURABLE OUTCOMES

This project will develop and deliver an integrated IPM program specifically designed for Maine’s wild blueberry growers. The University of Maine is the only U.S. institution developing wild blueberry IPM. When adopted, this program is expected to increase growers’; weed control efficacy, use of improved disease management tactics, control of blueberry tip midge, and understanding about management practices that may host plant sap feeding bugs that damage the crop. Seven outcomes will be quantified. Research and assessment is intended to be completed by the end date of the 12 month grant implementation period. Preliminary results and assessment related to education and outreach activities will be initiated within the timeline of this grant and some final results and recommendations will occur after the crop season and will be presented at Spring 2016 growers’ educational sessions.

Timeline	Weeds IPM Outcomes
2015 crop year	4. Evaluate currently registered and new herbicides with different modes of action to determine which herbicide or combination successfully control weeds showing resistance.
Winter, Spring, Summer 2015	5. Assess the efficacy of our grower outreach/education program by developing and delivering surveys to elucidate grower knowledge of weed resistance biology, specifics of weed resistance IPM, and identify features of the weed management program that growers are likely to adopt. Compare results to a July of 2013 survey of Maine wild blueberry growers at the education and Extension grower meetings in 2015.
Timeline	Disease IPM Outcomes
Winter through Spring 2015	6. Increase the number of growers using forecast methods for Botrytis blossom blight to 60% and increase or maintain the number of growers

	using mummy berry forecast method. Survey growers in March 2015 to determine use of infection period forecasts, the effect the information had on use of fungicides, and what level growers are monitoring and scouting their fields for fungal development. Increase growers' awareness of scientific models of disease control by providing data on infection risk.
Spring through Fall 2015	7. Develop a model of germination of mummy berries
Spring through Fall 2015	8. Develop reduced risk fungicide options to help manage resistance to controls and provide "softer" lower risk control options. Identify at least 1 alternative for control of these diseases by testing 6 lower risk fungicides over two years for their effectiveness in controlling leaf spots.
Timeline	Insect Pest IPM Outcomes
Spring through Fall 2015	9. Research and education outreach will be conducted to develop a safe and effective IPM plan for the blueberry tip midge including a monitoring and trapping program and an effective control option.
Fall 2014 through Summer 2015	10. Determine if current fertility and disease management practices are hosting sap feeding insects that damage the crop and reduce yield. Results and management implications will be disseminated at grower annual Extension schools in winter 2016.

VI. WORK PLAN

This funding will support the research and extension activities of an integrated pest management program for wild blueberries from October 1, 2014 to September 30, 2015. This project will be managed by the Wild Blueberry Commission of Maine in partnership with the University of Maine and the advice of the Wild Blueberry Advisory Committee. The Committee, a sub-committee of the WBC established by the Maine State Legislature in the 1940s to advise the University on research and Extension needs, will provide grower input to this IPM project. Activities include grower surveys, research, and Extension/education objectives.

The weeds IPM component included in this proposal continues a 3 year 2012-13 SCBG project proposal *Integrated Pest Management to Address Weed Control Resistance in the Maine Wild Blueberry Crop* that was funded for one year. Summary of the 2012-13 project includes; Identified Group 3 and Group 2, herbicides that could control *Festuca filiformis* resistant grass. Grasses have grown resistant to Group 5 herbicides hexazinone and terbacil, use of Group 2 & 3 herbicides in rotation will prevent further development of resistant grasses (Yarborough and Cote, 2014). In 2014 Wild Blueberry Pesticide Charts were updated with new herbicides options including the AI/Group numbers needed to manage weed resistance. Growers were informed about; 1) how to identify weed resistance and 2) identify and use herbicides with different modes of action and 3) reduce weed competition through use of cultural management, such as amending soil with sulfur, and cutting woody weeds to increase yields. Presentations on weed resistance identification and measures to determine and reduce weed competition to improve yields were made at the following meetings in wild blueberry growing areas; 6 winter IPM presentations in 5 towns, 9 Spring Integrated Pest Management scouting sessions over 3 months in 3 towns; and, a

summer annual wild blueberry growers' field day featuring IPM work. At the July field day, clicker survey results from growers indicated that 89% of the growers had seen resistant weeds and only 8% had not known about resistant weeds; and 43% of growers surveyed had changed practices to address weed resistance by scouting, rotating or combining herbicides and using cultural practices.

Objective 1: Evaluate new herbicide chemistry to prevent herbicide resistance, improve weed control efficacy in wild blueberry fields and develop and deliver an educational program on Weed Resistance Prevention practices.

In November 2013, a trial was set up at nine sites across the blueberry growing regions of Maine (Mid-coast to Downeast), representing a range of soils, weeds, grower management techniques and climate conditions to test weed control. Velpar/Sinbar /untreated plots were sprayed after pruning with Alion 5 oz/a, Matrix 2 oz/a, Sandea 1 oz/a, or nothing (check) in November of 2013; and treatments of Alion at 5oz/a on the Fall treatment, 6.5 oz/a for spring only, and Trellis at 1.6 lb/a were applied pre-emergence in April and May 2014.

At each site, three plots will be sprayed pre-emergence with Velpar 1 lb/a, Sinbar 2 lb/a, or nothing (check) in May 2014. The resulting treatments are as follows: Check, Velpar, Sinbar, Alion, Velpar+Alion, and Sinbar+Alion (fall, fall+spring, spring); Matrix, Velpar+Matrix, Sinbar+Matrix, Sandea, Velpar+Sandea, and Sinbar+Sandea will be applied in the fall; Trellis(spring), Velpar+Trellis (spring), Sinbar+Trellis(spring), and grower check(spring) for a total of 22 different treatments on 9 sites. Soil samples were taken to characterize site differences in pH, OM and soil texture and will be used to evaluate treatment differences. All sites will be evaluated for wild blueberry cover/phytotoxicity, broadleaf weed cover will be assessed using a Daubenmire cover scale converted to percent, and phytotoxicity was assessed using a scale of 0-10 (0=no damage, 10=dead) converted to percent. Data will be analyzed using a non-parametric one-way exact median test ($\alpha=0.05$) to compare each herbicide to the check, as well as the herbicide combinations to Velpar or Sinbar alone. These treatments need to be validated in 2015.

The above measureable outcomes focus on the evaluation of herbicides with differing modes of action. The program below will educate growers on their proper use of weed control options and survey them about their knowledge of weed resistance management.

Weed Resistance Prevention (WRP) practice - Develop program and deliver educational sessions

1. Produce paper and electronic version of WRP Fact Sheet.
2. Present results at Maine grower education meetings (see project summary above)
3. A University of Maine Cooperative Extension Fact Sheet based upon the research results on *Managing weed resistance in wild blueberries* will be written and published as a printed fact sheet guide and made available online at: www.wildblueberries.maine.edu

Objective 2: To forecast and research the major diseases: mummy berry blight, Botrytis blossom blight and leaf spots; provide growers disease forecasting, evaluate fungicides with new modes of actions to prevent resistance developing in fungal pathogens, and forecast emergence of Spotted Wing Drosophila and, Blueberry Maggot fly.

Disease Forecasting: The network of 14 weather stations is providing Dr. Annis the data for disease forecasting to growers. Fourteen stations have leaf wetness monitors, air and soil temperature probes, soil moisture probes, and equipment for transmitting the weather data via

cellular modem. Two stations also have cameras to monitor development of mummy berries. Stations will be deployed in grower's fields before the mummy berry season and collected after harvest. The weather data will be used to forecast and refine mummy berry and Botrytis blossom blight infections.

Predicting mummy berry spore producing apothecia development: Three experiments will be set up and soil temperature, humidity, air temperature, soil moisture and leaf wetness will be collected at each site. The three experiments will allow Dr. Annis to track the timing of development of apothecia under natural blueberry field conditions, in a field plot, and in the lab at the University of Maine to see when the apothecia emerge from the soil, how long they last and, if appropriate, track weather conditions during their development. 1. Two weather stations with cameras will focus on plots containing mummy berries and transmit a picture of mummy berry development at a set time daily. 2. A field plot experiment with mummy berries collected from various fields to determine genetic differences due to field locations. 3. A controlled environment lab experiment to determine parameters for fungus germination. A model will be developed that compares the development stages of the apothecia at each site. At the end of the infection season Dr. Annis will rate field sites with on-the-ground weather stations for diseases; for mummy berry (end of May) and Botrytis (mid-June). Disease ratings and weather conditions will be compared to determine if/how weather conditions affect disease level. This model will need 2-3 years of validation.

Virtual Weather Data: Exploring the use of virtual weather data for accuracy in disease forecasts may lead to a more cost effective program. In 2015, virtual weather data will be obtained from Skybit for all sites where the weather stations are deployed. Data will be downloaded and processed through our disease models by Glen Koehler, UMaine Cooperative Extension. Actual field station weather data and virtual data will be compared for data accuracy for predicting the risk of disease infection. If Skybit data shows promise it will need to be confirmed over 2 additional growing seasons.

Fungicide trials for leaf spot control and integration of lower risk fungicides: Field experiments will be set up in early and late June to test the efficacy of different options to control leaf spot disease. Treatments will include biopesticides with mode of actions that induce resistance mechanisms in the plants or have fungicidal activity and fungicides with different modes of action to reduce potential for fungicide resistance in fungi. Dr. Annis will rate the plots for leaf spot and stem disease in mid-July and early September, and assess for disease symptoms in late August. Leaf retention will be compared in early October and overwintering damage assessed in early April of the following year. Treatments will be compared with analysis of variance and the multiple experiments. Results will be presented at 2015-16 growers meetings.

Grower Recommendations: At 2015 spring growers meetings and as a handout in the spring Wild Blueberry Extension newsletter, Dr. Annis will provide growers with IPM information about mummy berry and Botrytis blight forecasts, coverage areas of the weather stations, and how to track plant and fungal development. Leaf wetness and temperature data will be monitored daily by Dr. Annis to provide growers up-to-date information on the disease forecasts and forecast recommendations at least twice a week during times of disease infection or insect emergence by email list, on the wild blueberry blog (<http://umaine.edu/blueberries/blog/>), and as

recorded phone messages. Growers will be surveyed again at spring growers' meetings (2015) to determine the level of use of the forecasts, the effect the information had on field scouting, monitoring and fungicide use. The weather data will also be used in spotted winged drosophila and blueberry fruit fly maggot emergence models to focus grower insect scouting efforts.

Objective 3: Develop IPM program for blueberry tip midge and determine impact of sap feeding insects on yield of wild blueberry crop.

In the spring of 2015 a replicated research study will be set out at the University of Maine Blueberry Hill Research Farm. Four treatment combinations will be overlaid onto 8 clones (replicates). The use of a clone as a replicate will allow us to evaluate the effect of plant genetic expression on the treatments. On each clone each of the four treatments will be laid out in contiguous plots with treatments applied in June during the prune year. The treatments will be: 1) a control where nothing is applied, 2) Bravo Weather Stik at a rate of 4 pts in 20 gal./acre, 3) Diammonium phosphate (DAP) at 400 lbs /acre, and 4) a combination of Bravo Weather Stik AND DAP at the same rates in #3 and #4. Soil and leaf tissue samples will be taken at the recommended times in the prune year. Throughout the growing season, into the early fall, standard plant growth parameters will be measured in each plot. Leaf spot disease lesions, and sap feeding insect incidence and damage will be measured. A three- way mixed model analysis of variance will be used to determine the health attributes of clones in the 4 treatment regimes. Results and management implications will be presented to growers at the annual winter Extension Wild Blueberry Schools in 2016.

Blueberry tip midge infestations have been surveyed for ten years and we have identified several fields that tend to harbor recurrent populations. A subset of these fields that are in the prune cycle will be selected for field study sites in 2015. In at least three fields we will lay out plots and assign the following treatments to the plots: 1) control unsprayed treatment, 2) plots treated with the insecticide Delegate (spinetoram) at 6 oz / acre, 3) plots treated with the insecticide Entrust (spinosyn) at 2 oz / acre, 4) plots treated with the growth regulator insecticide Rimon (novoluran) at 5 oz / acre. Three yellow pan traps, filled with water and a drop of dish detergent (to break the surface tension), will be placed in the center of each field as monitoring traps for blueberry tip midge. We have previously found that yellow pan traps are attractive traps for adult fly midges (Drummond unpublished data). Upon first trap capture of a tip midge adult we will initiate applications and continue at weekly intervals until adult midges are no longer caught at a site. In mid-summer and then again in early fall, the number of stems infested in each treatment plot will be estimated by deploying 10 randomly positioned 1 m² quadrat's in each plot and counting the total number of stems and those that have obvious signs of blueberry tip midge (curved stem with a terminal leaf gall). A two-way analysis of variance will be used to estimate the best control measure. Our hypothesis is that Rimon, a growth regulator with trans laminar movement across epidermis cells, will be the superior insecticide. If Drummond proves this, the information will be presented to growers at Extension education sessions in 2016.

Drs. Yarborough, Drummond, and Annis will present research results and grower recommendations at the following Extension education events that will occur after the 2015 crop year. Each are attended by 15 to 100 growers: The January Agricultural Trade Show, Augusta; March Wild Blueberry schools in Waldoboro, Ellsworth and Machias; 9 field IPM scouting sessions in Warren, Orland and Jonesboro during April, May, June; and July Annual wild

blueberry growers' field day, where 150 growers convene at the University of Maine Blueberry Hill Farm in Jonesboro.

TABLE 1. TIMELINE FOR IPM PROJECT, October 2014 – September 2015

Activity	Time Period- Begin and End	Personnel
Project Initiation – All IPM components, Weeds, Diseases and Insects	October 2014	Yarborough, Annis, Drummond, Kontur
Activity	Time Period- Begin and End	Personnel
Weed IPM - Application of Fall treatments	November, 2014	Yarborough, Cote
Update fact sheets and Pesticide charts	February 2015	Yarborough, Drummond, Annis, Cote
Disease IPM - Test weather stations and cameras, finalize locations for deploying weather stations	January - March	Annis & Research Assistant
3 Winter blueberry school meetings – IPM Presentations on Weeds, Diseases, insect pests, and grower surveys	March	Yarborough, Drummond, Annis,
9 IPM Field Scouting Sessions over 3 months in 3 locations	April, May, June	Yarborough, Drummond, Annis
Weed IPM - Application of spring treatments	April – May	Yarborough, Cote
Disease IPM - Set up and treat plots for testing of fungicides for control of mummy berry	April – May, 2015	Annis & Research Assistant
Disease - Monitor mummy berry development plots	April – May, 2015	Annis & Research Assistant
Disease - Set up weather stations, collect data, produce and publish forecasts on web, phone line and by email - Set up and process Skybit virtual data	April – August, 2015	Research Assistant, Annis, Koehler
Disease - Rate disease in mummy berry fungicide experiment	Late May	Annis & Research Assistant
Insect Pests – Plots laid out to test for sap feeding insects	Early June	Drummond, & Research Associate
Disease - Make leaf spot treatments, Rate for Botrytis blossom blight	early mid-June	Annis & Research Assistant
Disease – Leaf spot treatments, Preliminary analysis of mummy berry fungicide trial	Late June	Annis & Research Assistant
IPM Educational Sessions, Blueberry Hill Farm	July	Yarborough, Annis, Drummond
Weed IPM-Evaluate herbicide effectiveness	Late July	J. Cote
Disease/Weed IPM - Measure yield of mummy berry fungicide and weed control plots.	August	Annis, J. Cote & Research Assistant
Disease - Rate for leaf spots and stem	September	Annis and Research

diseases, Collect and maintain weather stations		Assistant
Final analysis of fungicide trial, analysis of weather data and disease levels Set up mummy berry plots for 2016	September	Annis & Research Assistant
Weed IPM - Develop WRP fact sheet	October, 2015	Yarborough
Final report to ME Dept. Ag.	November, 2015	Annis, Drummond, Yarborough, Kontur

VII. BUDGET / BUDGET NARRATIVE (2014-2015) See budget table below.

The Wild Blueberry Commission is requesting \$116,268 for this project. Project funds will provide University of Maine researchers Drs. David Yarborough, Seanna Annis and Frank Drummond funds to undertake all of the applied research and Extension outreach outlined in this proposal. The budget narrative for IPM outcomes 1-7 is as follows:

7. Salaries = \$55,835

- a. \$19,020 - Research associate J. Cote @ \$3,170/month for 6 months salaries.
- b. \$16,740 - Research assistant 6 months @ \$2,790 per month and
- c. \$2,535 for Glen Koehler Extension Educator partial summer salary @ two weeks for Virtual Weather Data Analysis.
- d. \$9,000 for 1 part time PT research assistant, and
- e. \$4,500 for 3 months summer salary Drummond @ \$1,500/mo.
- f. \$4,040 for 1 summer Student Research Assistant \$10.10/hr @ 40 hrs/wk for 10 weeks.

8. Benefits = \$20,917

- a. \$9,852 - Research associate \$19,020 @ 51.8% for 6 months.
- b. \$9,985 – Research Assistant + Extension Educator \$19,275 @ 51.8%
- c. \$720 - PT Research assistant \$9,000 @ 8.0% and
- d. \$360 for 3 months summer salary benefits, Drummond \$4,500 @ 8.0%.

9. In-state travel and lodging for BOTH research and Extension outreach = \$20,100.

Principal Investigators who are conducting research will be responsible for following the procedures including, as supervisors, signing approvals before travel occurs and is submitted to the University of Maine. University of Maine System Administrative Practice Letter Section IV-B Subject: Travel and Expense Procedures will be followed for this research and Extension project. All travel expenses will be submitted and approved through the University of Maine. Any projects that are federally funded will be controlled by federal guidelines and requirements if appropriate.

- a. \$3,300 for 7,500 miles at \$0.44/mile
- b. \$7,600 for field vehicle rental \$1,100 per month for 6 months = \$6,600 and \$1,000 for 5,000 total miles @ 20 miles/gal, \$4 per gal. Research travel is to set up, treat and evaluate fungicide efficacy field trials; Extension travel will be to set up and retrieve weather stations, set up plots monitoring the fungus, and travel to grower extension meetings.
- c. \$3,400 for car rental for 3 months @ \$1,000/mo. = \$3,000 and 2,000 total miles @ 20 mi/gal, \$4.00/gal. = \$400
- d. \$2,800 1 car rental, 2 months @ \$1,000/mo. = \$2,000 and 4,000 miles at 20 mi/gal at \$4.00/gal = \$800

- e. \$3,000 for 3 months lodging @ \$1,000/mo. Room for technician in Downeast Blueberry production area to carry out research.

10. Supplies = \$2,396

- a. \$1,000 for Petri dishes, chemicals for solutions and media, flags, stakes, sample collection materials, fungicide spray equipment, computer, stationary and microscope supplies.
- b. \$796 for wooden stakes, 300' tape measure, backpack sprayer nozzles and extended boom, flash drive for data backup.
- c. \$600 for sweep nets for monitoring, backpack sprayer nozzles, petri dishes, plant pots, potting soil, water bowl traps, paint, field microscope, flash drives for data backup.

11. Contractual = \$11,520. Procurement of leases or contracts for services required for this IPM disease management research will be required to have signature authority approvals referenced in the **University of Maine System Administrative Practice Letter : Purchasing Procedures Section VII-A.2 Page 1 of 31 Effective 9/7/12** and follow referenced procedures as appropriate. All contracts and lease expenses will be submitted through the University of Maine, Orono. Any projects that are federally funded shall meet all applicable standards and shall contain all necessary clauses required by federal or state statutes, rules and regulations. Faculty/Principal Investigators will comply with the requirements of the funding source.

- a. \$1,500 - 14 Cellular Data Connections for weather stations, 6 months each. **U.S. Cellular** - 10 phone lines to download weather data for 10 weather stations @ \$150 per cellular phone line.
- b. \$6,720 - **Agrinet** - for 4 weather stations @ \$90 x 4 for cellular connections = \$360; for 2 stations with camera connections @ \$40 x 6 months x 2 cameras = \$480; for 14 weather stations telemetry services @ \$420 each = \$5,880.
- c. \$3,300 - **Skybit** - for virtual weather data @ \$55 per month for 6 months \$330 per location for 10 locations that have weather stations for comparing purposes of actual and virtual data.

12. Other = \$5,500

- a. \$3,500 for publications printing of pesticide information charts and Extension Fact sheets and
- b. \$2,000 for mailing costs of the same as above (6a).

WEED RESISTANCE (WEED OUTCOMES 1-2) BUDGET = \$ 37,672

13. Salary Research associate - \$19,020 J Cote @ \$3,170/month for 6 months

14. Benefits Research associate - \$9,852 for 6 months @ 51.8%

15. In-state travel for BOTH research and Extension outreach - \$3,300 -7,500 miles at \$0.44/mile

16. Other - \$5,500 Publication and mailing costs - Extension fact sheets and pesticide charts

DISEASE PREVENTION AND FUNGICIDE RESISTANCE (Outcome 3-5) BUDGET = \$49,380

- 1. Salaries - \$19,275: for Research assistant 6 months @ \$2,790 per month = \$16,740; and \$2,535 for Glen Koehler - Extension Educator partial summer salary @ two weeks for Virtual Weather Data Analysis.
- 2. Benefits – \$9,985 - @ 51.8%.

3. In-State Travel - \$7,600 for 6 months. Field vehicle rental \$1,100 per month total \$6,600. \$1,000 for 5,000 total miles @ 20 miles /gal, \$4 per gal. Research travel is to set up, treat and evaluate fungicide efficacy field trials; Extension travel will be to set up and retrieve weather stations, set up plots monitoring the fungus, and travel to grower extension meetings.
4. Supplies - \$1,000 for Petri dishes, chemicals for solutions and media, flags, stakes, sample collection materials, fungicide spray equipment, computer, stationary and microscope supplies.
5. Contractual - \$11,520 - 14 Cellular Data Connections for weather stations, 6 months each. **U.S. Cellular** - \$1,500 @ \$150 per cellular phone line - 10 phone lines to download weather data for 10 weather stations **Agrinet** - \$6,720 - \$360 for 4 weather stations @ \$90 x 4 for cellular connections; \$480 total for 2 stations with camera connections @ \$40 x 6 months x 2 cameras. \$5,880 for 14 weather stations telemetry services @ \$420 each. **Skybit** - \$3,300 for virtual weather data @ \$55 per month for 6 months (\$330 per location) for 10 locations that have weather stations for comparing purposes of actual and virtual data.

NEW INSECT CONTROL (INSECT OUTCOMES 6-7) BUDGET = \$29,216

Outcomes 7&8 – IPM sap feeding insects & IPM blueberry tip midge

1. Salaries – \$17,540: a.) \$13,500 = \$9,000 for 1 part time (PT) research assistant, and \$4,500 for 3 months summer salary (Drummond) @ \$1,500/mo. + b.) \$4,040 – 1 summer Student Research Assistant (\$10.10/hr @ 40 hrs/wk for 10 weeks = \$4,040).
2. Benefits – \$1,080 = \$720 PT research assistant @ 8.0% and \$360 summer salary benefits (Drummond) @ 8.0%
3. In-state Travel – \$9,200: a.) \$3,400 = In-state travel for BOTH research and extension outreach - car rentals for 3 months @ \$1,000/mo. = \$3,000 and 2,000 total miles @ \$4.00/gal at 20 mi/gal = \$400 + b.) \$5,800 = In-state travel for BOTH research and Extension outreach: 1 car rental, 2 months @ \$1,000/mo. = \$2,000 and 4,000 miles at 20 mi/gal at \$4.00/gal = \$800 + \$3,000 Room for technician lodging in Downeast Blueberry production area to carry out research @ \$1,000/mo for 3 months.
4. Supplies – \$1,396: a.) \$796 for wooden stakes, 300' tape measure, backpack sprayer nozzles and extended boom, flash drive for data backup + b.) \$600 for sweep nets for monitoring, backpack sprayer nozzles, petri dishes, plant pots, potting soil, water bowl traps, paint, field microscope, flash drives for data backup

BUDGET (2014-2015)	
OBJECT CLASS CATEGORIES	
a. Personnel	\$55,835
b. Fringe Benefits	\$20,917
c. Travel (in-state)	\$20,100
d. Equipment	\$0

e. Supplies	\$2,396
f. Contractual	\$11,520
g. Construction	\$0
h. Other	\$5,500
i. Total Direct Charges (sum of 6a-6h)	\$116,268
j. TOTALS (sum of 6i and 6j)	\$116,268
PROGRAM INCOME	

VIII. PROJECT COMMITMENT

The Wild Blueberry Commission has agreed to work with the University of Maine which will provide all the staffing and supplies for the successful completion of this IPM research and Extension effort. The Wild Blueberry Commission Advisory Committee has and will provide grower input. The University of Maine wild blueberry IPM research and Extension program specialists are prepared to conduct the necessary IPM research and education projects to benefit the Maine's Wild Blueberry growers. Because the UMaine wild blueberry IPM program is the most direct source of farm management knowledge in the state and is the only one in the country, all of Maine's 510 wild blueberry growers stand to gain from this IPM research and Extension project effort. The Wild Blueberry Commission and the Wild Blueberry Advisory Committee are wholly committed to the implementation of the project.

II. PROJECT TITLE: Building a Hops Industry in Maine

ABSTRACT: Maine is a national leader in production of craft beers, yet most of this product is brewed from imported ingredients. Brewers have expressed a strong desire to brew their products with local hops, but presently there is little growing capacity for hops in Maine on a commercial scale. Development of a successful hops industry requires that we study which varieties are best adapted to Maine's climate, and which have the most desirable brewing characteristics. Of special concern is resistance to downy mildew, a potentially devastating disease of hops plants. We will plant twelve varieties of hops at the Agricultural Experiment Station in Monmouth, and evaluate growth characteristics, including plant survival, productivity and disease resistance, such as tolerance to downy mildew. The varieties will be evaluated for brewing and flavoring qualities at the Food Science Laboratory at the University of Maine in Orono. Interested growers and brewers will visit the trials and learn appropriate growing techniques, pest management strategies and variety characteristics. Results will be shared with growers and brewers through workshops, fact sheets and videos posted online. This project will determine which hops varieties will be best suited for Maine brewers and educate interested growers in sustainable hops production.

III. PROJECT PURPOSE

This proposal contains four objectives to be carried out by University of Maine research and Extension faculty and staff in cooperation with interested farmers and brewers. First (year one), establish a replicated trial of hops varieties at the Agricultural Research Station in Monmouth to evaluate plant characteristics, including winter survival, growth rate, maturity date, yield, and disease tolerance of each type. In the subsequent three years the three remaining objectives will be accomplished: Second, determine flavoring and brewing characteristics of different hops varieties grown in Maine at the University of Maine Food Technology Laboratory to determine which provide the greatest opportunities for local brewers. Third, develop resource materials for farmers to gain knowledge on best production practices for hops under Maine growing conditions. Fourth, work with Maine brewers to determine unique qualities and appropriate use of new hops varieties grown in Maine to encourage production of craft beers and other products using locally grown ingredients.

According to the Maine Brewers Guild, the state is home to over 50 breweries that produce over 200 different beers. Maine is a national leader in production of craft beers from small (micro) breweries that have found commercial success in local, regional and national markets. Yet, aside from water, most of the ingredients used to make these products are imported into the state, including the grains and hops that give the products their unique character. Developing a sustainable hops industry in Maine to meet the demand of our successful brewing industry will significantly enhance the competitiveness of specialty crops in the state by reducing our reliance on imported ingredients for Maine crafted beers. Hops have good potential as a commercial crop in Maine due to our climate, diverse farm base and strong market demand from local breweries that wish to make high quality beer with ingredients and characters distinct to Maine.

In order for commercial hops production to be successful within Maine, growers must be able to produce a high quality product that can match and exceed what is presently available from out of

state suppliers. This requires that growers understand which varieties of hops are best suited to both our growing conditions and the demands of local brewers. Many varieties of hops are available, coming from breeding programs in the US, Europe and New Zealand among others, but none have been specifically bred for Maine's unique climate and growing conditions. In addition, hops varieties vary greatly in their susceptibility to pest issues and their brewing and flavoring qualities. Constructing a hop yard is a significant investment (most estimates are around \$10,000 per acre), and selecting an appropriate variety is of critical importance to bringing a successful return. Selecting the correct variety will assure market demand for the product and can significantly reduce expensive inputs, such as pesticides, needed for a profitable harvest.

Establishing a variety trial of hops varieties at the Maine Agriculture and Forest Experiment Station will enable University of Maine crop and food science specialists to study the growing characteristics of different varieties, including yield and pest resistance, and their flavoring and brewing characteristics. Through this information varieties of the highest potential for success in Maine will be determined and recommended to farmers interested in pursuing this crop. In addition, the trial and experience gleaned from it will support the development of educational resources for farmers growing hops, including workshops and online informational pages supported by the University of Maine, which provide recommendations on variety selection, best cultural practices and pest management.

This project is timely because Maine breweries continue to expand, increasing output by more than 10% per year for the past five years. Some of Maine's larger brewers have expressed interest in increasing the use of locally grown ingredients in their products. In addition, Maine farmers, looking for potential high value crops to increase the diversity of their markets, have begun examining the potential for growing hops on their farms.

This proposal has NOT been submitted for funding to any other agency or USDA grants program. This proposal strengthens efforts by the MVSFGA, MOFGA, and the University of Maine to develop new markets and least-toxic integrated pest management (IPM) strategies for all important insect pests, weeds, and diseases.

IV. POTENTIAL IMPACTS

Maine has over 1000 small, diversified farms that could potentially adopt hops as a crop. In addition, Maine currently has over 50 commercial breweries that would be interested in purchasing locally grown hops. Based on the state's current production numbers for beer (over 7 million gallons), the industry currently purchases nearly half a million pounds of hops, paying between two and five dollars per pound. These numbers suggest that Maine could conservatively support approximately 250 acres of hops, with higher numbers if sales to neighboring states are initiated. It is likely that, initially, most of the production would be spread out in small hop yards amongst numerous farms growing hops as part of a diversified farm operation. Larger plantings would develop later as experience, market demand and crop value stimulate larger investments. Should the results of this project yield hops varieties with high potential for good production in Maine and good flavoring qualities, numerous Maine farmers could take advantage of the growing market demand for locally grown hops. Maine brewers

would have access to high quality locally produced hops, which would increase the marketing strength of their products by promoting more Maine ingredients and uniquely Maine qualities.

V. EXPECTED MEASURABLE OUTCOMES

Data collected from the hops trial at the Maine Agricultural and Forest Experiment Station will generate research-based recommendations for varieties suitable for production in Maine, and provide cultural and pest management practices that promote optimal yields and quality.

Data collected from chemical analysis of different hops varieties at the University of Maine Food Technology Laboratory will generate research-based recommendations on flavoring characteristics, such as bittering, and other brewing characteristics, that brewers can use to develop distinct and unique flavor qualities for their products. **Chemical analysis will occur once the plants are producing cones, expected in the second and third year of the project.**

The University of Maine will develop informational resources for hops growers to provide information on appropriate varieties, cultural techniques and pest management strategies for sustainable hops production in Maine. These will include online support in the form of fact sheets (we envision three) and a blog. A winter workshop on hops production will be held for growers in cooperation with the Maine Agricultural Trades Show, followed by a summer tour and demonstration of hops production at the trial site, once it is established (**years two and three of the project**). **Attendance at grower meetings will be recorded, and evaluations of each program will be requested from each participant. Use of the online resource developed through the project will be measured with Google Analytics to determine level of use and how users found the web page.**

The University of Maine Food Technology lab will develop descriptions of hops qualities (chemical, flavoring) that will help brewers determine which types will best suit the desired characteristics of their products. **Testing and analysis will be carried out once the bines are producing in years two and three of the project.** Brewers and growers will be invited to visit the testing facility and learn how these qualities are measured and how best to use this information in developing their products. Results and recommendations will also be readily accessible through on line articles.

Within five years of the start of the trial and based on the information gathered from it, we anticipate at least 10 Maine farms will be developing hop yards with the intent of commercial sales to local brewers. **We will develop a contact list of commercial growers through participation in meetings and use of resources developed through the project.**

Within ten years of the start of the trial, local brewers will be using Maine grown hops in some of their recipes and promoting their products based on locally produced ingredients.

VI. WORK PLAN

A replicated and randomized trial of hops varieties will be established at Highmoor Farm, Maine Agricultural and Forest Experiment Station in Monmouth during the spring of 2015. Twelve

varieties selected for high survival, yield and flavoring potential will be obtained as tissue culture stock from the Cornell University hops propagation program (see Table 1.) The plants will be spaced five feet apart within rows with fourteen feet between rows. Each experimental plot will have five plants of one variety. Each variety will be represented (replicated) three times within the planting in a randomized design for statistical analysis. A fourteen foot high trellis to support the bines will be installed in each row. We will be able to use some materials from past trellised apple studies to reduce construction costs. Data will be collected on plant establishment and susceptibility to disease, especially downy mildew, over three growing seasons. During the second and third seasons, the bines will be cut and cones harvested to collect yield data and evaluate cone characteristics among the varieties. Cones will then be sent to the Food Technology Laboratory at the University of Maine in Orono for flavor component analysis to determine bittering and other flavor characteristics that effect product qualities. **A crop technician, partially supported by the project, will be responsible for planting, trellis construction, pruning, fertilization, weed management and harvest. Student labor will be supplied by the project to support the crop technician, especially for weed management and harvest.**

Project funds will support activities outlined in this application and conducted by the Faculty Research and Extension team at the University of Maine.

TABLE 1. TIMELINE FOR HOPS DEVELOPMENT PROJECT, October 2014 – September 2017

Activity	Initiation	Termination	Personnel
Determine varieties for trial, site prep.	October 2014	November 2014	D. Handley M. Hutton J. Bolton
Establish variety trial at Highmoor Farm	June, 2015	November 2015	D. Handley M. Hutton J. Dill
Monitor bines for pest damage	July, 2015	October 2015	J. Dill D. Handley
Train bines to trellis	May 2015	September 2015	J. Dill D. Handley
Report to ME Dept. Agriculture	August, 2015	September, 2015	D. Handley J. Bolton
Monitor bines for pest damage	June 2016	October 2016	J. Dill D. Handley
Field demonstration for growers, brewers	August 2016	August 2016	D. Handley J. Dill J. Bolton
Harvest bines, record yield data	September 2016	October 2016	D. Handley M. Hutton J. Dill
Drying cones,	November 2016	January 2017	J. Bolton

analyzing flavoring characters			
Development of online fact sheets	January 2017	May 2017	D. Handley J. Bolton
Publication of flavoring characteristics	March, 2017	March 2017	J. Bolton
Winter workshop for growers and brewers	March 2017	March 2017	D. Handley M. Hutton J. Bolton J. Dill
Final report to ME Dept. Agriculture	August, 2017	September, 2017	D. Handley J. Bolton

VII. BUDGET / BUDGET NARRATIVE (October 2014- September 2015)

The University of Maine, requests \$11,210 for initiation of this project. **This amount will fund the first year of the anticipated three year project duration. The University of Maine, as administrator of the proposed grant project, will provide project funds to the faculty research and Extension personnel to undertake all of the applied research and Extension outreach outlined in this proposal.** These funds will cover the necessary inputs to initiate this applied research and extension project. This will include the establishment of a hops variety trial at Highmoor Farm (land fees, plants, soil amendments, trellis supplies). Much of the funding will support the labor needed to carry out the establishment and maintenance of the hops variety trial, and to collect the data. Some travel funds will be needed to transfer plant material from Highmoor farm to campus and to set up grower meetings to transfer information. **Travel funds will also be used to visit growers starting hops planting on their farms to gather information about growing practices, varieties, pest problems and anticipated markets. We anticipate similar funding requests for each of the next two years of the project.**

TOTAL BUDGET PROPOSED = \$11,210

FIRST YEAR BUDGET (September 2014- August 2015)

OBJECT CLASS CATEGORIES	
a. Personnel	
a. 0.25 Crop Tech	\$ 6240
b. %7.7 Fringe	\$ 480
c. Student (40 hours @ \$8.50)	\$ 340
b. Travel (in-state)	
a. 4200 miles @ \$0.44/mile	\$ 1850
c. Equipment	
e. Supplies	
Pruners (4 @ \$50)	\$ 200
Twine/wire	\$ 100
Chemicals (may include but not limited to):	\$ 1000
10-10-10, urea, calcium nitrate, flumioxazin, paraquat, clethodim, glyphosate, fosetyl-Al, boscalid/pyraclostrobin, spinosad, bifenthrin	
f. Contractual	
g. Construction	
h. Other	
Land Use for ½ acre hops yard (Maine Agriculture & Forest Experiment Station land use fee: \$1400/acre/year)	\$ 700
Printing (fact sheet series, meeting programs, evaluations, surveys, posters)	\$ 300
i. Total Direct Charges(sum of 6a-6h)	\$11,210

j. TOTALS (sum of 6i and 6j)	\$11,210
PROGRAM INCOME	

VIII. PROJECT OVERSIGHT

Dr. David Handley and Dr. Jason Bolton will be the lead researcher/Extension staff at the University and will provide regular updates on the program and the final report to be submitted to the ME Department of Agriculture and USDA as required. Dr. Handley and Dr. Hutton will oversee the establishment of the hops variety trial at Highmoor Farm. Dr. James Dill will take primary responsibility for monitoring and evaluating pest injury to the hops varieties in the trial. Dr. Jason Bolton will have primary responsibility for evaluating the drying and flavor analysis of the hops at the Food Science Laboratory following harvest. Dr. Handley and Dr. Bolton will ensure that Extension related outreach is developed, conducted and distributed at growers meetings and on our Extension websites

Dr. Handley is the Extension Vegetable and Small Fruit Specialist and a Cooperating Professor of Horticulture for the University of Maine. He is based at the Highmoor Farm Agricultural Experiment Station, where he carries out applied research regarding berry and vegetable variety evaluation, production techniques and pest management strategies. He coordinates statewide, integrated pest management (IPM) programs for strawberries and sweet corn. Dr. Handley is the author of numerous fact sheets, articles and newsletters, and co-editor of two regional small fruit production guides

Dr. Hutton is the Extension Vegetable Specialist and Associate Professor of Horticulture for the University of Maine. He is based at the Highmoor Farm Agricultural Experiment Station since 1994. His research and Extension program concentrate on evaluation new plant germplasm, sustainable and advanced production techniques.

Dr. Dill is the Extension IPM Specialist and a Cooperating professor in the School of Biology and Ecology at the University of Maine. His specialty is potatoes, vegetables, and small fruit crops. He coordinates the statewide, integrated pest management (IPM) program for potatoes and runs the plant pest and disease diagnostic laboratory at the University of Maine. Dr. Dill is the author of many Extension fact sheets and articles.

Dr. Bolton is the Extension Food Safety Specialist and Assistant Professor in the Department of Food Science and Human Nutrition. He recently developed and teaches an undergraduate course in brewing at the University of Maine in Orono.

IX. PROJECT COMMITMENT

The University of Maine will provide all the funding for staffing, operating costs and supplies for the successful completion of this project as presented in the budget. The University of Maine will be responsible for administration and reporting. In addition, after the project completion date

the University of Maine Cooperative Extension will continue to support hops production through the maintenance and continued development of Extension related educational resources. We have worked with the Maine Vegetable & Small Fruit Growers Association and the Maine Organic Farmers and Gardeners Association to develop this project. Both organizations are interested in alternative crops, such as hops, that could fit well into established operations and offer new markets to beginning farmers in the state.